Journal of the Royal Society of Arts

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FORTHCOMING MEETINGS

WEDNESDAY, 28TH APRIL, AT 2.30 p.m. (Joint meeting with the Faculty of Royal Designers for Industry.) PERCY SMITH MEMORIAL LECTURE. '*Letter Design and Type Cutting*', by Harry G. Carter, O.B.E., of the Oxford University Press, and lately Head of Typographic Design and Layout Section, H.M. Stationery Office. Sir Francis Meynell, R.D.I., Master of the Faculty of Royal Designers for Industry, will preside. The lecture will be illustrated with lantern slides.

WEDNESDAY, 5TH MAY, AT 2.30 p.m. '*Colour Television*', by Commander C. G. Mayer, U.S.N.R., O.B.E., M.I.E.E., European Technical Representative, Radio Corporation of America. Sir Noel Ashbridge, B.Sc., M.I.C.E., M.I.E.E., Chairman, Radio Research Board, Department of Scientific Industrial Research, will preside. The paper will be illustrated with a colour film and lantern slides.

THURSDAY, 6TH MAY, AT 5.15 p.m. COMMONWEALTH SECTION. '*The Forest Resources of the Colonial Territories and their Management*', by F. S. Collier, C.B.E., Forestry Adviser to the Colonial Office.

CHANGES IN THE COMMONWEALTH SECTION PROGRAMME

It is regretted that the Sir George Birdwood Memorial Lecture, which was to have been delivered at the end of the Session to the Commonwealth Section by Nihar-Ranjan Ray, M.A., D.Litt., D.Phil., Professor of Indian Art and Culture, University of Calcutta, on the subject of '*European Art in India*', will not take place as the lecturer will not, after all, be able to leave India to visit England this year.

In place of this lecture a further meeting has now been arranged in the Section for Tuesday, 25th May, at which Major-General Sir Leonard Rogers, K.C.S.I., C.I.E., M.D., F.R.C.P., F.R.S., will read a paper on '*Progress towards the Eradication of Leprosy from the British Commonwealth*'. Details of this meeting will be published in the *Journal* in due course.

BICENTENARY CELEBRATIONS OVERSEAS

In the last issue of the *Journal* a brief mention was made of two functions held to celebrate the Bicentenary overseas, in Bombay and Hong Kong. Reports have now been received of both of them of which the following is a summary.

Bombay

A very successful banquet was held at the Taj Mahal Hotel, on Monday, 29th March. Among those present were the Governor of Bombay; the Chief Justice of Bombay; the Mayor of Bombay; the Sheriff of Bombay; His Eminence the Cardinal; Ruling Princes; the Deputy High Commissioner of the United Kingdom in Bombay, and the President of the Bombay Chamber of Commerce. The following speech was made by Sir Fazal Ibrahim Rahimtoola, who had arranged the celebration:

> On behalf of the Fellows of the Royal Society of Arts resident in Bombay I offer to your Excellency and other distinguished guests a most cordial welcome. It does look strange that a function should be held in Bombay when the head-quarters of the Society are in London. But the Society's membership is spread all over the world. In India alone we have more than 120 members, some of whom are occupying very high positions, as, for example, our present Finance Minister, Sir Chintaman Deshmukh. Our Vice-President of India, Dr. Radhakrishnan, is a recipient of a medal from this Society and has sent us congratulations and good wishes. We have also received a message of best wishes for the success of the function from the Chairman, the Earl of Radnor, and members of the Council of the Society. Bombay has the largest number of members in India and it is in the fitness of things that she should also celebrate this event, like many other places abroad.
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> Bombay occupies a unique position by being a cosmopolitan and representative city of India as well as an important town in South East Asia. It is a pioneer industrial town, and is also appreciative of Arts and Science. It has taken a leading part in international functions and it is therefore a matter of great pleasure that we are meeting in Bombay this evening to celebrate the Bicentenary of the Royal Society of Arts.
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> *Sir Fazal then gave a short account of the history of the Society, and concluded:*
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> For India the Society has special value. Linked as we now are to Britain on a basis of complete political equality through the Commonwealth there is much economic advantage we can derive through an organization such as this dedicated to the encouragements of Arts, Manufactures and Commerce. The experience of this two-hundred-year old institution should be at once an incentive and a model to us. I commend it to the attention of the Government and the people.
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> The centenary of any institution is a great event, but to celebrate a Bicentenary is a unique achievement in the annals of its history, especially when the Society still continues to function as actively as before and has been able to maintain its position as an international institution. We, the Fellows of this Society, are proud of this day and are most grateful to Your Excellency and other distinguished guests who have associated with us and made this function a great success.

Hong Kong

The reception held at the home of Mr. C. W. Johnson, the Society's Honorary Corresponding Member, was also reported to have been a success and a telegram of congratulations was sent to the Society in London by those present. A photograph of the reception is printed below.

Some of the guests at the Hong Kong reception

MESSAGES OF CONGRATULATION

In addition to the messages of congratulations on the Society's Bicentenary published in the last issue of the *Journal*, letters and telegrams have been received from many organizations and individuals, including the following: the Charles Lamb Society; Fellows of the Royal Society of Arts in Hong Kong; Incorporated Plant Engineers; the Institute of Transport; Royal Academy of Dancing; Royal Welsh Agricultural Society; the Stockholm Royal Academy of Fine Arts, and the Textile Institute.

PRESS AND B.B.C. REPORTS OF THE BICENTENARY

Great interest has been taken by both the Press and the B.B.C. in the Society's Bicentenary; on 17th March the Bicentenary was the subject of an interview in the 'Panorama' programme of television with Mr. Gordon Russell, a member of the Council and Director of the Council of Industrial Design, as commentator; on the same day, Mr. Derek Hudson gave a talk in the European Service on the Society's new History; and on Sunday evening, 21st March, Professor

Nikolaus Pevsner gave a fifteen-minute talk in the Home Service, which was subsequently relayed in the General Overseas Programme, entitled '*Arts and Commerce Promoted*'; this talk was published in *The Listener*. Two talks on the Bicentenary are also known to have been broadcast from foreign stations: one of them by Herr Sieveking, President of the Patriotische Gesellschaft, was broadcast from Hamburg: the other, arranged by the British Council, from Brazil.

Most of the national newspapers and the leading periodicals have referred at length to the Society's celebrations. Many of them have also published feature articles on its history. The following newspapers and periodicals are among those which have published special articles, or given prominence to its activities, in connection with the Bicentenary:

Ambassador
Architects' Journal
Art & Industry
Birmingham Gazette
Birmingham Post
Board of Trade Journal
Builder
Cabinet Maker
Chemical Age
Chemistry & Industry
Chemist & Druggist
Children's Newspaper
Country Life
Daily Herald
Daily Mirror
Daily Telegraph
Design
Discovery
East Anglian Daily Times
Electrical Journal
Electrical Review
Engineer
Engineering
Evening News
Everybody's
Fairplay
Financial Times
Furniture Record
Gas Journal
Glasgow Herald
Hull Daily Mail
Illustrated Carpenter & Builder
Illustrated London News
Iron & Coal Trades Review
Ironmonger
Jewish Chronicle
John O'London's Weekly
Journal of Commerce
Lancashire Daily Post
Lancet
Listener
Manchester Guardian
Metal Industry
Mining Journal
Mining World
Motor Industry
Nature
Newcastle Journal
News Chronicle
News of the World
North Western Evening Mail
Northampton Independent
Northern Echo, Darlington
Outfitter
Oxford Mail
Paint, Oil & Colour Journal
Pharmaceutical Journal
Pottery Gazette
Recorder
Recorder Weekly
School Government Chronicle
Scope
Scotsman
Sheffield Telegraph
Shields Evening News
Shields Gazette
Shipping World
Smallholder
Sphere
Sunday Express
Swindon Evening Advertiser
Statist
Textile Manufacturer
The Times
Time Magazine
Times British Colonies Review
Times Science Review
Times Weekly Review
Transport World
Yorkshire Post

ARTS, MANUFACTURES AND COMMERCE 1754—1954

The Three Bicentenary Lectures

I. THE ARTS

By NIKOLAUS PEVSNER, C.B.E., M.A., Ph.D., F.S.A.,

Slade Professor of Fine Art, University of Cambridge

E. Munro Runtz, F.R.I.C.S., a Vice-President of the Society, in the Chair

Tuesday, 23rd March, 1954

THE CHAIRMAN: In its early years this Society was considerably interested in the fine arts, and still is, but not in so particular a way.

Greatly in the past has it aided the fine arts and, having conceived ideas for their advancement, has conceded the development to new societies and left them to stand alone. That is the Society's policy to-day, and some of our ideas may be analogous

The Lecturer

to the lucky dip or bran tub, from which by calculating chance we sometimes extract an inspired idea; if it meets with approval, we leave our child to adoption by those better able to educate, but we never lose interest in our kindred.

It is my privilege to-day to welcome our gifted speaker, Dr. Nikolaus Pevsner, Slade Professor of Fine Art at the University of Cambridge, from whom we shall learn much of the Society's past activities and changing policies, as we did last Sunday night when he spoke on the wireless.

The following lecture was then delivered.

THE LECTURE

'Arts and Commerce promoted', you read in handsome Roman letters on the frieze below the pediment of this building every time you enter it to listen to a paper and join in a discussion. The motto goes back to the Society's early days and must be understood in that way. Art had more connotations then than it has now: it still had a ring of that meaning which is preserved in the word 'artisan', and also of the other meaning which you have in the term 'the liberal arts'. So art or arts with that wide significance were to be promoted in their relation to commerce—and, I should add, to industry.

It is the object of these three bicentenary lectures to follow the relation of the Society to the arts, to industry, and to commerce in the two centuries of its existence and perhaps to try to peep into its future as well. I am concerned to-day with art, and I have already indicated that that includes what we call art now, but comprises much more.

In 1754 the Golden Age of English painting and English furniture and decorative art was only beginning. Hogarth, it is true, had done his work, but Reynolds was only 31, Gainsborough 27, and Josiah Wedgwood had not yet established his factory which he was to call Etruria. There were none but small private art schools in London, there was no academy to give artists a higher social status, there were no exhibitions of art, and there was no public encouragement of the beginner or the master in art.

In all these fields the Society started improvements at once. France had shown what could be done. The French Academy of Painting and Sculpture had been an established and powerful institution for more than a hundred years. It held art exhibitions too, and these had been reformed and made into a regular institution in 1737. So in 1755 Sir Henry Cheere, the sculptor, approached the Society to sponsor the creation of an academy of art, and it is typical of England in the eighteenth century that the initiative did not come from the king and his ministers, but from a private man to a private society. Similarly in 1759 Robert Edge Pine, and in 1760 Francis Hayman, approached it to sponsor art exhibitions. The academy at first came to nothing, but an exhibition was indeed held in 1760, the first ever undertaken in this country. It did not work too well: the artists resented their limited dependence on the Society and besides quarrelled amongst themselves. A secession therefore took place almost at once, and the Society stopped its exhibitions in 1764. Meanwhile Reynolds, Gainsborough, Wilson and others, went on holding their exhibitions, and out of them, after more quarrels, arose the Royal Academy,

which received the king's blessing in 1768, another private institution to do what a royal institution had done in France.

The Society had taken the initiative, the ball was set rolling, and another body in the end was the beneficiary. We shall find this as a recurrent motif in the history of all the activities of the Society.

In industry and commerce its method of promoting progress was the award of premiums in money and also in medals. This principle was applied to art as well. For instance, English painting had for centuries been hardly more than the provision of portraits. Hogarth had started a new genre—contemporary moralities. But history painting in the sense in which it was the tradition of other countries barely existed. Religious painting of course was unable, and allegory in the grand manner, except on the ceilings of palaces, was also too rare, to establish a national school that could compete for instance with France. You will notice that I am judging here according to the standards established by the theorists of Italy and France, which are also the standards of Reynolds's *Discourses*, if not of most of his paintings. That he was a better painter when he did portraits than when he attempted subject painting does not at present matter. The fact remains that the grand manner was the grand manner and as such considered intrinsically superior to portrait and landscape. So to introduce the grand manner into English painting was a task accepted as important and therefore a task which the Society at once decided to undertake. But what they were aiming at was not allegory or mythology, but history painting.

This was a period of glorious expansion: 1757 is the date of Clive's victory at Plassey, 1759 of Hawke's at Quiberon Bay, 1759 to 1763 of the occupation of French Canada. So when in 1763 a competition was held for 'original historical paintings, the subjects taken from British or Irish history', Romney received an award for a picture of the death of General Wolfe. Benjamin West's more famous *Death of General Wolfe* was painted eight years later. Then, on moving into this building the Society proposed to commission eight historical paintings from Reynolds, West, Romney, Mortimer, Wright of Derby and others—a very intelligent choice, we can now see. In the end, as you know, James Barry painted the pictures which surround us here. They took him six years, and he put all his best efforts into them, because he, as against Reynolds, really believed with his whole heart in the necessity of art with a historical and moral meaning.

A society, a corporate body, can hardly improve the æsthetic quality of painting, but it can direct subject matter, and this, with the intention of filling a regrettable gap in English art, your Society attempted to do. Perhaps we would be happier now if we had, instead of Barry's, such paintings here as Wright of Derby's *Orrery* and *An Experiment with the Air Pump*, but, as a testimony of what English painting in the international allegorical and historical style could do in the later eighteenth century, James Barry's pictures are more instructive and illuminating than any other contemporary cycle.

Meanwhile, apart from the encouragement of the accomplished artist, that of the beginner was not forgotten, and drawing and modelling prizes were

given to children for what is indeed often amazingly competent work. Thus Flaxman got a premium at the age of 11, Nollekens at the age of 12, Lawrence at the age of 15, Mortimer at the age of 18, and later Mulready aged 15, Landseer aged 10, Frith aged 17, and John Everett Millais aged 10. Some architects also received awards when they were between 14 and 20: James Gandon, Sir Robert Smirke, Philip Hardwick, Blore, Donaldson and Wyatt Papworth.

But that was not all. So far indeed I have spoken of art in our sense exclusively and not in any union with commerce and industry. But that problem was also tackled immediately. Again France had shown the way. Colbert, the virtual founder of the Academy of Painting and Sculpture, was fully aware of the commercial value of art in the economy of a country. Flourishing national tapestry workshops for instance, with the highest artistic standards, would surely help to increase exports and reduce imports. The French care for decorative arts and national workshops was imitated in many countries, and, together with such official interest, by a country or town, in the training of designers, an art school was often established where no systematic teaching had been in existence before. I have in a book of mine[1] tried to assemble the names and foundation dates of these schools, and I do not want to give more than a few examples here: reorganization to foster national industry, Vienna 1725 and again 1770, Dresden 1763, St. Petersburg 1764, Berlin 1770, Copenhagen 1771, Stockholm 1773, The Hague, 1779; foundations to serve industries, Geneva 1751, Glasgow 1753, Mayence 1757, Hanau 1757, Edinburgh 1760, Karlsruhe 1770, Barcelona 1775. As for France, twelve provincial schools were started between 1738 and 1760. These schools, to emphasize it once more, were the first art schools in their respective towns. Until then the artist had learnt his trade as an apprentice in the workshop or studio of a master. But while there he learnt his whole trade, teaching in the art schools was entirely in terms of draughtsmanship. First drawing from drawings, then drawing from plaster casts, then drawing from life—that was the syllabus. The application of the skill acquired in this manner to painting or sculpture or to tapestry and porcelain remained the task of the workshop.

There were in England, as I have already said, some private art schools in existence at the time when your Society was founded and got into its stride. So it made no effort to teach future designers, but as it wanted all the same to encourage them it at once promised premiums for designs for specific trades, for embroidery and silk weaving, for calico-printing and paper-staining, for coach-builders, cabinet-makers and brass-founders, and so on, because, it argued, 'Fancy, Design and Taste' are 'necessary to all persons concerned in Building, Furniture, Dress, Toys, or any other Matters where Elegance and Ornament are required'.

That sounds a very good scheme, but the odd thing is that it came to nought. Response was small, and in 1778 this encouragement of industrial arts, if we give them the name invented for them by Prince Albert, was discontinued. The lack of response is surprising, considering that these were the very years when Wedgwood, for instance, proved that England could do as well as France in the

export of the finest decorative art, and when he employed Flaxman, and Mrs. Coade John Bacon, and when Chippendale made his furniture and innumerable silversmiths their exquisite tableware.

Why this failure? Is the answer perhaps that craft needed no encouragement yet in England? That its production and distribution were not yet dislocated, that indeed industry had not yet begun its destructive work? That is certainly one answer, and the fact that the Society's immense early success belongs to the years immediately before the Industrial Revolution, and not to the Industrial Revolution itself, is, I think, fundamental for the understanding of its whole early history. But it will be for another lecture to bring that out.

Meanwhile there is another answer as well, and one which shows that the Society was perhaps after all not without influence on this *fleuraison* of decorative art in England. The 'Polite Arts', as they were still characteristically called, was one of six committees of the Society. The others were 'Agriculture', 'Chemistry', 'Manufactures', 'Mechanics', and 'Colonies and Trade'. It can be assumed that those who became members took an interest to a certain extent in all of them. For in 1754 the Industrial Revolution had not yet arrived, and that specialization of interest and activities which has helped progress so much in the nineteenth and twentieth centuries, and at the same time deprived all of us of what you might call an all-round culture, was still unknown. Subscription to the Society was two guineas a year for gentlemen (for peers it was more) and that represents about twenty in purchasing power now. Yet look at the early lists of members and you find, putting on record with hard cash their interest in agriculture and mechanics, in chemistry and art, such a wide variety of men as Horace Walpole, and Joseph Banks, Roubiliac and Doctor Arne, Garrick and Gibbon, the Earl of Chatham and the Earl of Chesterfield, Robert Adam and Benjamin Franklin, Drummond the Banker and Thrale the Brewer, Chippendale and Sheridan, Sterne and Stubbs, Doctor Johnson and Doctor Hunter.

Now as all these attended (with diverse frequency, it is true), they represented and helped to establish a public enlightened enough and leisured enough to appreciate art as much as mechanical invention and to be proud of a million newly planted trees as much as of skill and fine craftsmanship in earthenware or cabinet-work.

The Industrial Revolution changed all that. The new class of wealth and power was by and large neither enlightened nor leisured, and whereas the Society could in its early days stipulate that only such inventions and improvements qualified for awards and medals as were not patented, that could no longer be done without keeping out much of the most fruitful work. The rule was repealed in 1845. If you plant half a million trees, you are proud of it and ready to receive a medal as a token of public recognition of an action meant as much to improve your country in general as your own estate. If you invent a better carriage to bring fresh fish to London, your dominant motive might still be to a large extent to help the population of London, even if you also may think of your own pocket. But now, as big factories sprang up in the Stroud Valley, in Derbyshire, in Lancashire and the West Riding, first of four and five stories

with a façade adorned by a classical pediment and a cupola (Polite Art united to industry), and then of seven and eight stories without any unnecessary embellishments, it became clearer and ever clearer that the manufacturer was led on to inventiveness and tenacious massive work predominantly by self-interest. He did not produce to benefit his country.

This is the phase in English history which the Hammonds have christened the Bleak Age. Factory legislation was slow to come, conditions of the workers, including women and children, were bad. The Society busied itself with experimental work and awards for apparatus to improve working conditions: dust exhausts, fire extinguishers, and so on. But how far could that go? Especially as at the same time a distinguished member of the Society could recommend the establishment of a carpet industry in England, because it would create employment for 'women and children who are thus rendered profitable to the public, and moral in their conduct, instead of being burthensome or loose in their way of life'.

But I am here concerned with the Industrial Revolution only as far as it affects our subject—the union of Art and Industry. Now there you all know that with the decline of hand-making and the spread of machine-making, with the decline of individual and the spread of mass production, all standards of art collapsed. The manufacturer was no longer capable of judging between good and bad, he was—for lack of education and leisure—more attracted by the vulgar than by the refined, and in any case he did not manufacture to elevate his customers, but to satisfy their equally untrained and crude tastes.

The Society was powerless, it was indeed at its wits' end, and it would no doubt have settled down to a discreet demise, if it had not been for a new set of young, eminently energetic and admirably far-seeing men who were wholly in sympathy with their age and yet, where necessary, savagely critical of it.

Prince Albert was 24 when he was elected President in 1843. He never regarded being president or chairman of anything as a sinecure. So he began at once to apply his never-failing accuracy of analysis and his astonishing determination to the Society, and first of all looked back at what its terms of reference had been at the beginning. They had been, as you know, ARTS AND COMMERCE PROMOTED. Was their union promoted now? Did the Society do anything to promote it? The answers were clearly 'no' in both cases. So Prince Albert prescribed: 'To wed mechanical skill with high art is a task worthy of the Society of Arts and directly in the path of its duty'. He said that in 1846. In the same year the Society offered prizes for 'useful objects calculated to improve general taste'. The objects submitted were shown at a small exhibition. Amongst them was the famous tea-set by Felix Summerly, Victorian in its embellishments, but remarkably sparing in their application and remarkably sensible in the shapes. Felix Summerly is, as you know, the pseudonym of Henry Cole. Cole was 38 in 1846. He was Assistant Keeper at the Record Office and had already busied himself with remarkable energy on diverse good causes, Penny Postage and Brunel's Wide Railway Gauge amongst them. He had also brought out simple toys for children, the first Christmas card ever produced, *The Home*

Treasury, a children's picture book, reproductions of Dürer's woodcuts—that is, simple, vigorously designed art for the people—and charts for railway passengers to tell them of the sights which their train was passing.

Having obtained this prize for his tea-set, Cole began to issue, still under the name Felix Summerly, more Art Manufactures (as he called them) designed by him and his friends, such as the painters William Mulready and Richard Redgrave, and the architect Owen Jones. In 1847 Cole was elected to the Council of the Society, and in 1847 the Society received its Charter. In it, it was stated that its purpose was to serve 'the employment of the poor, the increase of trade, the riches and honour of the Kingdom'. There is a new tone in this, and one can sense Prince Albert behind it.

His interest must have influenced the holding of a competition in 1848 for cheap housing, and it may also be behind some revived endeavour to help Fine Art. For Albert, like the early directors of the Society, believed in the ennobling quality of great art and was disappointed in the lack of great art—that was to a certain extent still art with great subjects—in England. He came from Germany, where in the wake of Goethe such high-minded art was encouraged by courts as well as cultured and wealthy private people, and he wanted to do likewise. It was due to him that wall-painting of historical subjects, as you have them in this room, was stipulated for the new Houses of Parliament, and that competitions were held in 1842 to 1843, and again in 1844 and 1847, to find suitable talent for them.

Concurrently, Cole advocated exhibitions at the Society of the work of one leading artist a year, out of which one or a few works should be bought to help assemble a National Gallery of British Art. It is characteristic that the first of these exhibitions was devoted to the work of Mulready, who designed for Cole's Art Manufactures. But it is also characteristic that in 1850 these exhibitions were given up. In 1853 all premiums for Fine Art, which had gone on ever since the Society had been founded, were also given up. The Society saw now at last that the promotion of Fine Art was not its function.

Its function lay, to say it once more, in the application of art to industry, and in this context the most important events of the years between 1846 and 1850 were the exhibitions of 'Select Specimens of British Manufacture and Decorative Art', of which I have mentioned the first in connection with the Summerly tea-set. Twenty thousand people saw it. A second was held in 1848 and seen by seventy-three thousand, a third, in 1849, had over a hundred thousand visitors. Then they were discontinued because work had begun on the Great Exhibition, and this was to afford an infinitely more conspicuous platform for improved design. The catalogue of the exhibition said this: 'It is a universal complaint amongst manufacturers that the taste for good art does not exist in sufficient extent to reward them for the cost of producing superior work—that the public prefer the vulgar, the gaudy, the ugly even, to the beautiful and perfect. We are persuaded that if artistic manufactures are not appreciated, it is because they are not widely enough known.' We must now see how far the Society was right in this opinion.

The Great Exhibition was to give the aims of the Society world-wide promotion. The story of the exhibition is by now sufficiently familiar for me to skip it here. The part played in its conception by Cole and by Prince Albert, the immense work put into it by Cole and others such as Wentworth Dilke and Matthew Digby Wyatt, the infectious enthusiasm of the Prince, all this needs no comment. But there is one aspect I must bring out here. The Exhibition consisted of four sections: raw materials, machinery, manufactures, and sculpture, etc. Its motive was the pride of Britain in the achievement of her industries, a fully justified pride. As the building was unprecedented in its bold use of materials and its ingenious technique of assembly, so British trades wished to show the world that what they had accomplished was equally novel and bold and ingenious. And as free trade and a free exchange of ideas were the credo of the age, so foreign nations were invited to exhibit their best too and show what they could do better than Britain or what they would have to learn from her.

All this was very well for machinery and manufactures, and neither Cole nor Prince Albert could have had the least misgivings on this score. But when it came to industrial art, their whole attitude, or at least Cole's, was bound to be different. He cannot have looked to its display with unruffled enthusiasm. His feelings must have been mixed, and forebodings must have loomed large. For it is not only now that we think lowly of what England did in applied art about 1850—no, Cole and his friends thought very much as we do. Cole had sponsored from 1849 to 1852 the publication of a remarkable magazine, called the *Journal of Design and Manufactures*, the purpose of which was to publish what was good and to criticize what was not. The editor was Richard Redgrave and the criticism, I assure you, was healthily outspoken.

Here are a few points from this memorable magazine: Guttapercha ornaments at the Society of Arts exhibition of 1849 are 'a pure abomination', a gas bracket is 'a vulgar piece of absurdity', a wooden platter designed by no less a man than John Bell is called coarse in workmanship and ugly in design, and so on.[2] Nor did Felix Summerly escape criticism; the 'crying defect' of a cellaret made by John Bell for him is commented on.[3] Such criticism may sound arbitrary and not sufficiently supported, but it was based on a clear conception of the fundamental shortcomings of Victorian design: the lack of 'general agreement in principles of taste' is noted. 'Everyone elects his own style of art. . . . We all agree only in being wretched imitators . . . aping effete conventionalities.'[4]

From the public's point of view, the Great Exhibition was a huge success, and a triumph for Prince Albert as well as for the Society. Its membership rose in a steep curve after 1851, until it reached the three thousand mark by about 1865, but its outcome in terms of industrial art was a shock; perhaps not to the general public, perhaps not even to Prince Albert, and certainly not to Queen Victoria, but to that inner circle of the Society with which we are concerned, it undoubtedly was. The quality and the character of the art and applied art at the Exhibition was so baffling that I have myself written a whole (admittedly small) book[5] to account for it.

Anyway what, from the point of view of the Society, makes even that failure

yet another triumph is that the promoters did not hide for reasons of gentility what they thought of it, but that the failure was faced and formulated with ruthless clarity. This seems to me so important that once again I want to read a number of passages to you. First our friend, the *Journal of Design:* 'A fruitless struggle to produce . . . novelty without beauty, beauty without intelligence; all work without faith.'[6] Then, a little later, an article in *The Times* was reprinted and the following preface added: 'The absence of any fixed principles in ornamental design is most apparent in the Exhibition . . . The most serious violation of principle . . . is the negation of utility as paramount to ornament. All European nations at the present time begin manufactures with ornament and put utility in the background. The best things are the least ornamented.'[7]

Then Richard Redgrave in his *Report by the Juries:* 'The leading error of the Exhibition' is that 'utility and construction are made secondary to decoration.' This is 'apt to sicken us of decoration and leads us to acclaim those objects of absolute utility where use is so paramount that ornament is repudiated. . . . The hunger after novelty is quite insatiable; heaven and earth are racked for novel inventions, and happy is the man who lights upon something, however *outré*, that shall strike the vulgar mind.' Ornamental artists either 'superstitiously reverence the remains of past ages—or despise them and copy nature uncritically.' But ornament directly imitated from nature is 'of the most objectionable kind.' What ought to be done instead is to study the principles of past styles and of nature and follow them. Finally 'ornament wholly effected by machinery . . . is certainly the most degraded'.[8] And so on with details of all the various trades represented.

Finally Matthew Digby Wyatt[9] in his lecture to this Society in the series on the Results of the Exhibition (April 21st, 1852): 'In consistency of design,' he says, 'those we had been apt to regard as almost savages' (he means the peoples of the Orient) 'were infinitely our superiors.'[10] And to castigate the surfeit of decoration in the objects exhibited, he quotes a Frenchman who said of some bed: '*On ne pourrait même bâiller sans casser un Cupidon*'.

But all this criticism was by no means wholly negative. Not only were many exhibits praised by Wyatt, but he as well as Redgrave, and later Owen Jones in his famous *Grammar of Ornament* of 1857, were most explicit in stating what principles ought to have guided the manufacturers of 1851 and what principles ought to guide manufacturers in future. Here once more are some passages illustrating these principles. They are strikingly topical still.

Again we must start with the *Journal of Design* because it came first: 'Ornament is not . . . principal, . . . it must necessarily be secondary to the thing decorated.' 'The best age is the simplest—the decline is marked by the increase of ornament.' Ornament should always be looked at as 'suited to particular uses, situations or fabrics' and entirely 'unbiased by custom, by precedent, or by the authority of great names' (William Dyce).[11] Ruskin is blamed for not developing in his *Seven Lamps* a 'theory of mechanical repetition as applied to art' and not 'recognizing the tendencies of the age, which is inevitable'

(M. D. Wyatt).[12] As for the relation of design to fine art 'the arbitrary barriers that have been drawn between their special departments' ought to be removed.[13]

And then, to go into more detail: Brick ought not to be faced by 'the stucco abomination' (this was years before William Morris's Red House!); the 'merely imitative use of nature in metalwork', candlesticks 'supported on the toes of leaves and finger-ends of flowers', is unjustifiable, carpets should have flat ornamentation and not 'landscapes with palm-trees and skies placed for us to walk over' or 'gigantic tropical plants, shown in high relief, and suggestive of anything but a level or plane'.[14]

Ornament should be 'related to the process by which [it] is to be executed' (Dyce). The designer ought to be 'perfectly conversant' with these processes (Dyce). 'The manufacturer and designer [should be] one individual doubly gifted, or . . . the manufacturer [should] . . . master so much of the elements of design as shall at least enable him to judiciously control the artist; or . . . the artist, by a careful study of the material and its manufacture [should] elaborate a system of design in harmony with, and special to, the peculiarities so evolved' (Wyatt)[15].

Two more topical bits in addition: 'A class for the instruction of buyers would be of great value', and 'a collection of some two hundred and twenty (textile) patterns' contains 'at least two hundred more than could be any reasonable necessity for at one season and from one firm'.[16] How well we know these arguments!

They appear again and again after the exhibition. I may perhaps be allowed to quote Wyatt, because he lectured here, and because he was my predecessor at Cambridge: 'Without a due attention to simplicity, fitness has never been adequately carried out. We must never deceive—by too direct an imitation of nature, by using one material in the peculiar style . . . incident to another, by borrowing ornaments expressive of lofty associations, and sanctioning by a borrowed form the presumption that it may have been made for a wholly different object, or in a totally different way'. These passages are surprising, are they not? They formed without any doubt the foundation on which William Morris could begin to build the edifice of his theory. He moved into the Red House in 1859 and furnished and decorated it according to these principles, and in 1861 founded the firm of Morris, Marshall and Faulkner, Fine Art Workmen in Painting, Carving, Furniture and the Metals, to produce and sell things made on the same principles.

There are, of course, differences between Cole's and Morris's attitude. Cole believed in promoting and administering, Morris believed in making. That is why he succeeded far beyond Cole. Also, Cole believed in exhibitions, associations, legislation: Morris believed in incessant preaching. The Victoria and Albert Museum, Cole's creation with the help of the Society, could, we know now, do for the live art of design infinitely less than Morris's union of sermons and settles, of wisdom and wall-paper. But there is one aspect under which Cole seems to us more of our century than Morris. Cole had faith in industry and the

machine; Morris loathed them. Did the Society grasp that aspect? That is what we must now examine.

The Exhibition of Photography held in 1852, the first exhibition of photography held in England, was a sign that it did. But by about 1860, the critical impetus of the Cole circle had all but spent itself. Owen Jones's *Grammar* was used at the School of Design, but his principles had no appreciable success against the roaring flood of Victorian taste. William Morris's reform, on the other hand, supported by so much furious energy and passionate faith, soon gathered momentum. Royal Patronage enabled these adventurous young men to re-decorate rooms in St. James's Palace in 1866 to 1867, and in 1867 they were also commissioned to do the new dining-room at the Victoria and Albert Museum.

The Society took notice of this, but while in 1851 it had led the world in its display as well as its criticism of current industrial art, in the 1860's it was weak and showed little initiative. I am referring here, of course, only to industrial art, and I am not concerned with the success of the Society in other fields. Prizes for decorative art done by artisans in 1861, prizes for the execution in mosaic of two paintings in 1862, prizes for woodcarving in 1863: that was all.

Finally, when the 1870's had arrived, the Society settled down to following the Morris Movement—for this is, I suggest, how its various activities in the useful arts from 1870 onwards ought to be interpreted. I had told you that Morris called his firm Fine Art Workmen. Well, in 1870 to 1871 prizes were given by the Society for Art Workmanship. Exhibitions of 'Selected Works of Fine and Industrial Art' were organized by the Society for the 1851 Commissioners in 1871, 1872, 1873 and 1874. Prizes for Art Woodcarving appear in 1873, for Art Furniture in 1881. I have, in a special paper in *The Architectural Review*[17], shown the connotations of this particular term and its fashionable appeal in the 1860's and 1870's. Finally, a section on Applied Art was started in the general lecture programme of the Society in 1887, to be continued till 1908.

Now those were the years in which the gospel of Morris spread and England became once again for a time the leading country in applied art, or art for the home. But, let it be said at once, the whole world-wide success was won in terms of hand-made rather than machine-made things. Nothing came out of Morris and Co. that was machine-made, and his followers, who banded themselves together first in the 'Art Workers' Guild', established in 1883, and then in the Arts and Crafts Exhibition Society, founded in 1888, believed in the same moral, social and æsthetic duty towards the craftsman as against the designer. It was this principle, laid down and developed so brilliantly by Morris himself in his lectures (which he began to give in 1877), that deprived England in the end of her leadership in industrial art, and it is a matter for regret that the Society instead of contradicting Morris in this one point—his implacable hatred of the factory and the designer—followed him. The Society ought to have returned with resolution to Cole.

You will believe me when I say that I do not under-estimate Morris's greatness as a man and an artist and the importance of his work both as a designer and as a

preacher. I have, I hope, proved sufficiently in my writings how great my admiration is for him. But it is a fact that he could not solve one fundamental contradiction which runs through all his work. He preached: 'What business have we with art at all unless all can share it?' but he insisted that all that was issued by his firm was made in such a way as to raise its price far above the means of the 'all.' Of course, he did in the end influence their taste, but as a rule through the coarsened work of imitators working for manufacturers.

However, there were some younger men of great creative talent who, although they had been impressed and influenced by the teachings of William Morris, had none of his sense of taboo against the machine, and the most notable of these was Charles Voysey, who was rightly made an R.D.I. He did designs from printed textiles for Martin's, wall-papers for Essex's and Jeffrey's, carpets for Tomkinson's and Ginzkey's, tiles for Pilkington's, metalwork for Elsley's, and so on and so on. But he was—I knew him—certainly not a machine-minded man, and for a wholehearted recognition of our machine age as such we must go abroad, and so the æsthetics of an industrial art truly of the twentieth century were evolved abroad. Moreover, as far as this Society goes, Voysey was honoured in 1938 when he was eighty-one years old.

In the years on which he chiefly left his mark, the Society to the best of my knowledge did not help to formulate the arguments for and against the hand and for and against the machine. It lacked the clear-sightedness which it had possessed thanks to Cole and his friends in 1850. It did not take the lead, nor was it early in recognizing the lead taken by, say, the German *Werkbund*, which had been founded as early as 1907 and established almost at once its function to promote and improve æsthetic standards of machine art. It is painful now to see the Society so forgetful of the most positive aspects of Cole, Matthew Digby Wyatt and the *Journal of Design*.

The change finally came with the formation of an Industrial Art Committee in 1917. But that, you must not forget, was two years after the formation of the Design and Industries Association, so that the credit of having been first in England in accepting the new attitude of the *Werkbund* has to go once more outside the Society. The next step was Sir Frank Warner's Industrial Art Competitions. They began in 1924. After that came the Burlington House Exhibition of 1935, undertaken jointly with the Royal Academy. I will not say much here of that. The Society has called it 'the first important British Exhibition of design in modern times', but it was not. It was preceded by the DIA Dorland Hall Exhibition of 1933, and this moreover was in my opinion more constructive in its choice of objects. I criticized the Burlington House Exhibition at the time in a book of mine[18], but I am an outsider and not much self-criticism of the Cole and Wyatt kind seems to have issued from within the Society. After Burlington House came the introduction of the R.D.I., some more exhibitions, and finally the pleading for a suitable commemoration of the centenary of 1851, which in the end led to that outstanding architectural achievement, the Festival of Britain.

And this brings me to the present. You will expect from me as a historian and

a critic and a friend of twenty years' standing that I should try to review the situation to-day as I see it and give you my private views as to the future.

The situation is not at all easy. This is a private Society. It must emphatically remain so. It has about six thousand members, which is a gratifying lot but not enough to finance what ought to be done. Considering that there were two thousand, two hundred years ago, ready to pay the present day equivalent of twenty guineas each and more in order to belong and help, what is needed now is either a subscription of twenty guineas which, clearly, economic conditions do not allow, or twenty thousand members. This is a mass age: what was financed by a limited patronage in 1750 must be financed by considerably larger numbers now.

That is one thing, but there is a snag here. Increased membership must not encumber administration. Unless the administration is simple, the Society is bound to lose some of its potential striking power. And what will attract these future large numbers of Fellows is the very striking power which was so spectacular in 1750 and 1850. Now where should it strike?

The traditional line taken by it is to find out what needs doing for Art, Commerce and Industry, and start doing it. Then—that seems almost every time the both encouraging and discouraging end of the story—others see that the Society was right to take over, with the result that a special organization is established for that one thing and the Society has to discover another good cause. It held the first art exhibition, and then the Royal Academy was founded; it held the first exhibition of photography and then the Royal Photographic Society was founded; it promoted the 1851 Exhibition and the Government took over; it pleaded for the Festival of Britain and handed that idea on to the Government. It started examinations in individual trades and that led to the formation of the City and Guilds Institute. It held exhibitions of inventions and now you go to the Patent Office to study inventions. And so on and so forth.

But little is left to-day that is—thanks to the irresistible nineteenth and twentieth century trend towards specialization—not covered by a special department or council or society or association. Design in Industry? There is the DIA—private like your Society—and there is the CoID with all the facilities and the backing of the Government behind it. Propaganda for modern art? There is the Arts Council. Education of the designer? The Royal College of Art has been thoroughly overhauled and does a great deal now.

What is left then? There are in my opinion various answers. The most general answer is that Industrial Art is only one aspect of this Society. The advantage it has over most other societies is that it has preserved its all-roundness. In this age of sub-division of labour it is good to have a place where science and art are still looked after simultaneously and in conjunction. The gentlemen of 1750 were interested in both and understood something of both. It will be a sad day when there is nothing left but specialists and when the amateur, the virtuoso, the man of all-round culture has disappeared. The B.B.C.'s Third Programme gives us a balanced supply of all-round information and stimulus, but let it not be said that a Society can hand over its communications to a microphone.

Secondly, the Society, being entirely private, can cover more than the B.B.C. It is in a position of complete freedom to choose causes and get things started without delay.

Thirdly, it has by reason of its private nature the tremendous advantage of being able to criticize. May it never be satisfied with 'effete conventionalities', may it never be smug! Henry Cole was not, he was exacting: so was Prince Albert. I see splendid twentieth century possibilities there.

So much for the general answers. Now for some special answers. First, we should not forget that in spite of all the existing organizations, not all the avenues are yet explored. Here are a few suggestions, large and small, for what they are worth. A Repository of Industrial Art might be assembled by gifts begged from manufacturers. It might be formed into a permanent collection with many small changing travelling exhibitions. Too little is as yet done in that way. Smaller towns far too rarely see a representation of what is best in strictly modern textiles or pottery or furniture, and the Society being private could be more uncompromising in its selection than for instance the CID. No flirtation with period escapism. Grace, yes: decoration, yes, but let them be wholly of this age of ours.

Then research is needed into consumers' preferences, into design and its premisses and conditions abroad—much on the lines of my own research for Birmingham University in 1934 to 1935 into conditions over here—and also into the rôle of craft in an industrial civilization, not as an escape into the 'olde worlde', but as an experimental outpost helping to establish new ideas amongst the relatively few who can afford to spend money on a really first-rate, beautifully made and imaginitively designed cloth or sideboard. And that brings me to my main special point for the future.

The conditions of modern industrial design in this country are curious. It started amongst the educated upper middle class—it has still the strongest hold there. Since then it has made much progress in the less affluent middle classes and some inroads into the skilled working class. But it has not been successful amongst the poor who want the modern, but want it jazzy, nor amongst the rich and socially most influential who want the antique, genuine or imitated.

There is no lead in contemporary design yet coming from on high, and the language of our century will not be universal in this country until that is achieved. There you have a task worth spending all one's energies on. Don't say that it is only natural for different classes to wish to express themselves in completely different styles, one modern and one, say, Georgian. That may be true at present here; it is not so, for instance, in Sweden, where the difference between the rich and the poor house is a matter of materials, of finishes, of workmanship (hand-making, for instance, against machine-making) but not of style. Surely that is a healthier state of affairs. How can it be accomplished here? Don't ask me. I only know that it must, and that it will need much determination and tenacity, much diplomacy and much faith.

I may sound sceptical and unenthusiastic in these last remarks of mine. That is, I may say, the privilege of the historian, but I assure you I am full of

hope. This Society has never been more successful and more influential than in the 1840's. It had a new President then, and he was 24 years old. He was 31 at the time of the Great Exhibition. You have a young President once again, and much that worries the quinquagenarians and sexagenarians is no problem for the young. You know that the Society means something to its President. He is not with us to-day, but I am looking to him in presenting you with my wishes for your third century.

THE CHAIRMAN: Dr. Pevsner has indeed given us a wide survey and has read a most interesting paper. He has warned the Society about its future conduct and we shall have to give grave consideration to some of the suggestions he has made concerning our future activities. I can assure you that that will be done.

You will wish me to propose a hearty vote of thanks to Dr. Pevsner for the excellent afternoon's entertainment that he has provided.

The vote of thanks was carried with acclamation, and the meeting ended with tea in the library.

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Sir Ben Lockspeiser

II. MANUFACTURES

By SIR BEN LOCKSPEISER, K.C.B., F.R.S.,
Secretary, Department of Scientific and Industrial Research

Sir Edward Crowe, K.C.M.G., a Vice-President of the Society, in the Chair

Wednesday, 24th March, 1954

THE CHAIRMAN: I have a message for you from our Chairman, the Earl of Radnor, who said he was very sorry that he could not be with you to-day and so he has asked me to take his place.

You will remember that the other day, in the inspiring message which we received from our President, the Duke of Edinburgh, he said that we would be addressed in our Bicentenary Lectures by outstanding personalities in their respective fields. Now I do not want to bring blushes to the cheek of my friend Sir Ben Lockspeiser, whom I have the pleasure of introducing to you, but he is, without any doubt or question an outstanding personality in the scientific field.

His experience has been very varied. He was head of the Air Defence Department of the Royal Aircraft Establishment at Farnborough from 1937 to 1939, and he progressed through various stages until he became Director General of Scientific Research in the Ministry of Aircraft Production in 1945 and later on he became Chief Scientist to the Ministry of Supply in 1949. That means to say that he was dealing with most of the important scientific aspects of the war as seen from the Air Ministry, Ministry of Aircraft Production and Ministry of Supply, and that he knew everything that was going on from the war angle. Since 1949 he has switched to industry and now in his capacity as Secretary of the Department of Scientific and Industrial Research he knows everything about science in industry, so he knows both sides. But as he has had so much experience in flying and aeroplanes I think—he may disagree with this, but I think—his deepest interest is in that direction, and it is this that makes him an expert on guided weapons. He is Chairman of the Nuclear Physics Committee which deals with the allocation of funds for nuclear research. In the aviation world, he holds advanced ideas relating to the future developments of aeroplanes, particularly in relation to aerodromes and landing grounds. And, finally, do not think that he is only a scientist. Amongst all his other accomplishments let me tell you that he is a very fine pianist and that he ran his own orchestra at Farnborough.

The following lecture was then delivered:

THE LECTURE

If it is true that people get the governments they deserve, it is also true that they get the societies they desire; and whereas governments, even good ones, soon come to an end, a well-founded Society may go on for centuries. Such a one, which has had a beneficent influence on the life and culture of Britain for two centuries, is the Society for the Encouragement of Arts, Manufactures and Commerce. It was born just in time, for within a few years of the meeting at Rawthmell's coffee-house Arkwright was driving his new spinning frames with Derbyshire water power, and James Watt was ready to light the fire which

was to send steam power racing through the arteries of the new industries. Textiles, steam engines, iron and steel were no new things when the first minutes of the Society were written, but before the century was out a handful of men from Lancashire and the Lowlands of Scotland, with a genius for mechanical invention, brought into being machines which step by step have removed the drudgery of centuries and made abundance possible. Arkwright, Hargreaves, Crompton and Watt exercised so decisive an influence on the course of industrial and social history that by the middle of the nineteenth century a predominantly agricultural people had become the manufacturers and carriers of the world, creating an economic power which provided the material basis for our supremacy in markets and affairs.

The birth of the Society at this time was no lucky accident. It was made by the times for the times. This was Johnson's England and Samuel Johnson himself was an early member of the Society, and was pronounced by Arkwright 'to be the only person who, on a first view, understood both the principle and powers of his complicated piece of machinery'. This makes strange reading to-day, but this was a period when the cult of science was widespread among educated classes. Priestley, who did more than any single man to transform chemistry from mediæval alchemy into a science, was a Unitarian Minister, and the Teddington curate, Stephen Hales, physiologist, chemist, botanist, and pioneer of ventilation, was a founder member of the Society. Curiosity and experiment were shaking men's minds free from obscurantism and superstition, and were producing a ferment which was to loosen, disintegrate, and ultimately transform, the entire social, economic and political structure. The Society at the time could hardly have measured the significance of these events. It was sufficient for the practical-minded and public-spirited men who founded it to know that there was a growing stream of scientific investigation and invention which should be stimulated and turned to practical account. It was refreshingly free from snobbery, recognized that 'genius (was) not confined to any particular rank', and wore its modesty well in declaring in the first of the Annual Transactions of the Society in 1783:

> It is not our intention to insinuate that the rewards given by the Society have been, in any degree, equal to the national advantages obtained by them: we mean only to show what great benefits have been and may be derived from small means well administered.

Kay's invention of the flying shuttle, twenty years before this period begins, probably stimulated the mechanization of the far more complex processes of spinning. The weaver had always needed the output of several spinners, but the disparity was now greater. The Transactions of 1783 record that Hargreaves' Spinning Jenny 'is now at so high a degree of perfection that one woman is thereby enabled, with ease, to spin a hundred threads of cotton at a time', and this number was soon to be increased many times. But the machine gave not only quantity but quality. It produced a much stronger cotton yarn, strong enough to replace the expensive linen warp threads and further cheapened the manufacture of cotton textiles. The mechanization of weaving, however, lagged

behind that of spinning, for although the first power loom was invented in 1785 there were still, when Queen Victoria came to the Throne, twice as many hand looms in the cotton workers' homes as there were power looms in the mills. No fundamental transformation in weaving had been accomplished comparable with the revolution that had occurred in spinning.

When Lancashire began her spectacular advance the only industry of any great importance was the woollen industry, whose high quality products found a ready market abroad. The industry established itself wherever sheep farming was most concentrated, but especially in Norfolk, the West of England, the West Riding, and the Southern Uplands of Scotland. There was a world-wide shortage of raw wool. Its export from Britain was prohibited by law, and Britain herself was importing it—mainly the wool from the long-haired merino sheep from Spain which was needed for the highest quality cloth. There was water power in Norfolk for the new machines, but the industry there, failing to adopt them, completely disappeared, leaving only the monuments of a great tradition and a rich culture. Cotton was generally ahead of wool in introducing new machines, and in wool the West Riding led the other areas.

Sixteen years before the Great Exhibition cotton goods accounted for fifty per cent of our total exports, and in a rapidly expanding world market the cotton industry virtually carried half of England on its back until just after the beginning of the First World War, when Lancashire was exporting three times more than all the other exporting countries put together. But the pattern of world trade has now changed. The place of cotton textiles in world trade has declined, its share having been roughly halved since the beginning of this century, due largely to the fact that this industry is usually one of the first to be fostered by a newly developing country. The climate of world trade has, however, been relatively more favourable for wool, and the United Kingdom share in this trade in woollen and worsted cloth has risen in the past twenty years from forty to just over fifty per cent.

The nineteenth century brought many relatively minor textile inventions, mainly improvements to existing machines with the exception of the new wool-combing machine, a significant advance which made its appearance at mid-century. But mechanical engineering seems now to be coming to grips once more with the textile industry. One can detect a twentieth century look about the fully automatic loom, and the modern knitting machine is an outstanding piece of mechanical ingenuity. Striking advances, however, were made in the finishing trades, in bleaching, dyeing and printing, in which the chemist played a strong hand. He had a finger in the pie since the very early years when the discovery of chlorine in 1774 was followed in ten years or so by its application to bleaching: it both shortened the bleaching period and eliminated the harmful process of using sulphuric acid. This had wide and far-reaching consequences. It was the first major contribution of chemistry to industry, and the opening, in the early years of the nineteenth century, of the St. Rollox Works in Glasgow for the production of bleaching powder marked the beginning of the British chemical industry, which was later to grow, still more closely with and increasingly

dependent on the research laboratory, and become, in its development and manufacture of so rich a variety of industrial products, one of the mainstays of our economy.

Since Perkin's discovery of Mauveine in 1856, the first commercial synthetic dye, the power of the organic chemist has been steadily increasing until now it can be said, with the introduction of man-made fibres, such as rayon, cellulose acetate, nylon, and the latest British fibre 'Terylene', that the scientific research laboratory has effected a revolution of its own in textiles. For the first time in history man is no longer tied to natural fibres, valuable though they are, and a significant feature of this advance is that the manufacture of the new fibres can be controlled to produce particular properties and in suitable lengths to enable an entirely new range of products to be made, either from a particular fibre or fibres or from a combination of man-made and natural fibres. This new scientific advance has invaded every field of the textile manufacturer from hosiery to dress and industrial fabrics of all kinds. We are no doubt only at the beginning of an innovation which has already had a profound influence in the world of textiles. The production of man-made fibres now comprises about twenty-five per cent of the total world production of cotton and wool together, and according to an official report on economic trends in the United States it is predicted that production, in that country, will amount to almost seventy per cent of the combined cotton and wool textile fibres within twenty-five years.

But so much of the future was to rest with Watt that we must return to him —our first great technologist, a practical engineer and a man of science. The combination is important. Watt had had on his mind for several years the Newcomen engine, which had been in use since the early years of the eighteenth century, pumping water out of collieries and tin and copper mines. It was, however, too expensive for general use as a source of power, using too much coal for the work it did. Watt was a friend of Joseph Black, of Edinburgh, and was associated with him in his discovery of latent heat, and, in particular, in the measurement of the latent heat of steam. All this was academically of fundamental importance which Watt the scientist could fully appreciate, but Watt the engineer could see also the significance of Black's work in explaining the reason for the inefficiency of the Newcomen engine, and the engineer in Watt found the solution by leading the steam away from the cylinder to a separate condenser. A simple idea with stupendous consequences. 'Nature has a weak side if we can only find it out', was how Watt put it, and having found it out improvements tumbled out of his fertile mind. Watt joined Boulton, a shrewd and capable businessman with a flourishing ironworks at Soho, Birmingham, who was on the look out for more motive power than his scanty water power could provide, and it was the historic partnership of Boulton and Watt that led directly to the revolution of motive power on which industrial Britain was founded. 'I have here, Sir,' said Boulton to Boswell, 'what all the world desires to have— Power.' Boulton was right then, he is right now and he will still be right when the Tricentenary celebrations of the Society come round.

This was nearly a hundred years before the Great Exhibition, and by the time that was opened James Watt's engine in one form or another was doing the work of countless horses in the mills, mines and in the factories, and driving agricultural machinery, trains and ships. The firm of Boulton and Watt displayed with pride a 700 horse-power marine unit for screw propulsion at that Exhibition. Their pride was well justified. The credit for the invention belonged to them, virtually the whole of the development of the steam engine as a prime mover had been done in this country, and our trading accounts reflected the magnitude of the enterprise.

This was not achieved without an essential parallel advance in production engineering. Something more was required in fitting pistons to cylinders than that they should not 'err the thickness of an old shilling in any part', and Watt turned to John Wilkinson, who in 1774 had patented a mill for boring cast iron cylinders whereby the casting was rotated about a fixed boring bar along which the cutting tool was traversed, obtaining by this method a much more uniform bore. This both ensured the success of the engine and set new standards in precision engineering which was later to be firmly established in principle and practice by Whitworth, whose stand of machine tools at the Exhibition was of such variety and excellence as to win the admiration of the world. Whitworth measured and standardized. His technique of 'end measurements' gave as he claimed 'all the accuracy we can desire', and the degree of precision achieved by his methods enabled machine parts to become interchangeable. Whitworth standardized the screw thread, enabling a nut made in Birmingham to fit a bolt from Manchester, and only in recent years has it become possible, by the wider adoption of a uniform standard, to fit a British nut to an American bolt. Precision of measurement, standardization and interchangeability were the essential steps in quantity and quality production and introduced the multiplication table into manufacture by machinery. The refinements of scientific measurement, new alloys discovered by the metallurgist, increased power and speed of operation, automatic control and a host of ingenious mechanical devices have all contributed to the great variety of machine tools of to-day but they are based, nevertheless, on the principles and practice of Whitworth.

If the steam engine owed its efficiency to the scientific study of latent heat it repaid its debt handsomely by prompting engineers and scientists familiar with its working to think about the fundamentals, and to delve into the mystery of heat, which was universally considered to be a kind of fluid called 'caloric'. It was supposed that this could be set free under certain conditions, for example, when in boring cannon the metal was reduced to powder. Rumford dealt the first blow at this theory by showing that the heat capacity of the powder was the same as that of the parent metal, and concluded that the only possible source of the heat was friction. James Prescott Joule, working in Manchester, established the equivalence of heat and mechanical work by direct measurement, and just before the middle of the nineteenth century completed his experiments, which demonstrated not only the convertibility of heat, mechanical work and electricity, but established these relations on a quantitative basis. The fundamental concept,

born of the physicists and the steam engineers, was energy, convertible, transformable and indestructible, expressed in the nineteenth century as the law of the conservation of energy, the fundamental nature of which has been broadened, and the understanding of the nature of things deepened by Einstein's derivation, in this century, of the equivalence and interconversion of energy and matter.

Carnot, in France, went on to formulate the ideal conditions under which the maximum amount of work could be extracted when heat is transferred from a high to a low temperature. He was the first to show that the work to be obtained from any heat engine was strictly limited and depended on the highest and lowest temperatures in the working cycle; the first to appreciate the essential distinction between reversible and irreversible heat flow, and that reversible working conditions gave rise to the maximum working efficiency. One of the results of great practical consequence which emerged was the refrigerator which derived simply from the theoretical conclusion that an ideal heat engine would deliver equally effectively work if heat were put into it and cold if work were put into it. The work of Joule and Carnot was, besides its practical importance, of the utmost theoretical significance, and became formally expressed as the first and second laws of thermodynamics.

It must not be supposed, however, that the steam engineers of either the eighteenth or nineteenth century were waiting for these basic theoretical conceptions. James Watt built his condensing steam engine years before the science or even the word of thermodynamics was heard of. George Stephenson powered his Rocket with an even cruder steam engine. He made his way on self-taught engineering principles and ingenious mechanical devices. His locomotive was woefully inefficient thermodynamically (as our steam locomotives are to this day) but fuel was cheap and abundant, and even on roughly laid tracks the 'Rocket' could travel much faster and pull many times more in a single haul than the horse. It is true that the steam locomotive had the objectionable habit of belching forth vast volumes of black smoke, and we can wonder to-day at the advanced views of Parliament which virtually made it compulsory to burn only coke in the fire-boxes of the early railway engines. But the practical and financial success of the Liverpool-Manchester railway justified, for many years, Stephenson's conviction that 'railways will come to supersede all other methods of conveyance in this country'. The profits of cotton were invested in iron rails. By 1846, 10,000 miles of railway track had been authorized by Parliament, and when the Great Exhibition was opened the general framework of the railway system as we know it to-day was complete. The population came by train.

Many may not have noticed there an early gas engine from the United States, the only internal combustion engine at the Exhibition, and none could have foreseen the fundamental changes that were to be wrought by replacing coal and steam first by gas and later by oil and petrol. The four-stroke cycle gas engine was largely pioneered abroad, the main contribution from this country being from Dugald Clerk who, in the latter part of the century, introduced the two-stroke cycle and the idea of supercharging, which was later to become of fundamental

importance to all types of internal combustion reciprocating engines. The first compression ignition oil engine was produced in this country by Akroyd Stuart in 1890, but the credit for the development of the constant pressure cycle belongs to Diesel of Germany, after whom this type of engine came to be known. But the most significant and fateful line of evolution was through the petrol engine. It made the motor car possible and it also enabled the Wright brothers, fifty years ago, to fly for the first time. The Wright engine, a great achievement at the time, weighed about twelve pounds per B.H.P. as against the modern figure of just over one pound. Many countries have contributed to the present degree of excellence and performance of the petrol engine, but it is doubtful whether any country has had such good fortune as was showered on us by the genius of Royce. We owe to the firm founded by Royce and to the team of engineers who had been trained by him the Merlin engine which fought its way with the heart of a lion through the Battle of Britain.

Watt's mantle of scientist engineer fell on Parsons, who gave the world its first practical steam turbine in 1884. Its rotary principle gave it mechanical advantages over the push and pull of the piston engine, and its utilization of steam by expansion in a large number of successive stages gave it an advantage in efficiency. It gained in power for weight by its capacity to run at very high peripheral speeds, and Parsons followed up his triumph by designing a speed reducing gear for driving slower-running units, notably marine screws. The first commercial use of the Parsons turbine for generating electric power was made in America in 1896, but Parsons, determined to interest a sea-going nation in his turbine, built the *Turbinia*, a vessel of one hundred tons, powered her with a 2,000 h.p. steam turbine and took her to the Diamond Jubilee Review at Spithead, where the demonstration of her superior speed and manœuvrability could hardly be overlooked. Thereafter the steam turbine quickly replaced the piston steam engine for large ships, and soon became established also as the most economical prime mover in the generation of large scale electric power. Parsons brought a wealth of science and engineering to his turbine, and by successive innovations, culminating in the introduction of his vacuum augmentor, brought down the consumption of steam per kilo-watt hour from two hundred to about eight pounds. This took about thirty years and the deep mark left by Parsons on prime movers can be seen to-day in the four 50,000 h.p. turbines driving the *Queen Elizabeth* and the 100,000 kw. unit in the Battersea power station.

The evolution of the steam turbine to the internal combustion or gas turbine was foreseen by Parsons, who anticipated modern practice by constructing the first axial flow compressor in 1901. But neither Parsons nor anyone else could design this vital component with the required degree of efficiency before the advent of the aeroplane had stimulated the study of aerodynamics and the scientific principles underlying fluid flow became established. But flying also stimulated the development of the gas turbine for quite another and more compelling reason. Aircraft propellers become subject to increasing drag conditions under a combination of rotational and linear velocities above about 400 m.p.h., entailing a sharp drop in their efficiency. Whittle pioneered

with the sharp perception that propulsion by the reaction of a high speed jet of gas, whose propulsive efficiency increased with forward speed (up to and beyond supersonic velocities), would get over this, and, also, that such a jet with the necessary thrust could be obtained from the exhaust of the simplest form of gas turbine—and at high altitudes also where conditions for high speed flight are most favourable. This was 1929. The day of the axial compressor had not yet arrived, and Whittle turned to the centrifugal compressor based on the supercharger of the aero piston engine, which he developed and improved to a high efficiency, and the first turbo jet engine in this country was built to Whittle's designs in 1937. Under the compelling influence of war, progress was extremely rapid, and the turbo jet has swept the field in high speed flight. The combination of science and practical engineering which began with Watt still exercises its power. British industry is exploiting the gas turbine with a vigour and skill which is reminiscent of the old Soho foundry, and the excellence of British aircraft to-day matches the power of its engines. Enterprise of this kind has always been, and is to-day, one of the sure ways to the future. British aviation exports were worth £65 million last year with the prospect of a greatly increased figure this year. A wealth of science, original design and high-class engineering has been poured into this industry, which has also stimulated the discovery and commercial production of light alloys. At the beginning of this century aluminium was little more than a scientific curiosity, a low density weak metal of about five tons per square inch tensile strength. Under the spur of necessity aluminium alloys have been developed for aircraft with a tensile strength as high as forty tons per square inch, and a density one third that of steel. Light alloys are finding their way into land and sea transport, but it is doubtful whether sufficient advantage has been taken in this country in land transport of the high strength to weight ratios of light alloys, especially where acceleration and deceleration are a major factor in operation.

It may be expected that the use of the gas turbine will spread as widely to the land and sea as the steam turbine did earlier. It cannot at present claim any advantage in thermal efficiency over the diesel or the steam turbine, and it cannot yet compete on an economic basis with the steam turbine power station plant fired either by coal or heavy oil. But it has yet to take advantage of much higher working temperatures which may come from new alloys or blade cooling or both. There is no reason to suppose that it will not be constructed to run on any present-day fuel and, with a long era of development before it, we may expect that the gas turbine will take a leading place among prime movers on the land and sea as well as in the air. Even at present, however, its land operation carries the advantage of operation without cooling water, which may not be of more than occasional importance in this country but can be of vital significance in those parts of the world where water is scarce. Factors such as these may exercise an important part in the ever-changing pattern of our export trade. Meanwhile, the gas turbine is finding a place in power stations as a peak load set, in utilizing industrial waste heat and boosting air supplies for steel furnaces.

At sea, the first crossing of the Atlantic in a ship propelled by a gas turbine was

made in 1953 by a tanker built and powered in this country. And the latest British marine gas turbine, burning diesel oil, shortly to undergo sea trials, demonstrated on the test-bed its capacity to deliver about a third more horse-power for about half the weight of the steam turbine in current use. The economic advantages flowing from the saving of weight and space in the engine rooms of liners and merchant ships are alone bound to give a strong impetus to the development of the gas turbine for the marine propulsion of the future.

A visitor to the Great Exhibition first saw, as it was fully intended that he should, a huge block of coal weighing twenty-four tons. 'The strength of Britain', said George Stephenson in his blunt way, 'lies in her iron and coal beds. . . . The Lord Chancellor now sits upon a bag of wool, but wool has long ceased to be emblematical of the staple commodity of England. He ought to sit on a bag of coals.' Hard but true. As a nation, however, we are sitting on fabulous treasure —our known deposits of workable coal total at least 150,000 million tons—which if we could only win it in greater measure, would give power to our economy and credit to our balance of payments. In 1800 when steam power was first used for winding coal to the surface, our coal production was rather more than ten million tons a year, since when it continued to rise at a clanking pace to reach at the outbreak of the First World War about 290 million tons. Annual exports, which rose to nearly ninety million tons in 1938, were, in addition to the raw materials they brought in exchange, a major factor in determining our dominant position as merchant carriers over the seven seas. Recent years have brought a decline where we can least afford it. Our present annual production is running at 220 to 230 million tons, of which we have little to spare for export, and indeed we have to keep careful watch to make ends meet at home.

We are experiencing to-day a return of the fuel shortage of two centuries ago. By the middle of the eighteenth century the forests which covered much of England in the Middle Ages had largely been cut down. Much was burned for fuel. The building of a single ship of the line took 4,000 fully grown oak trees, and charcoal was used exclusively and extensively for iron smelting. Nobody had been able to overcome the ruinous effect of the sulphur in coal to enable it to be used for smelting iron until Abram Darby, the first of three generations of iron-masters, began, and carried to a successful conclusion, his experiments with coke smelting at Coalbrookdale. This was about a year after Johnson was born, and prepared the way for the industrial revolution he could not have foreseen. The Darbys and their associates were men of independence, integrity and enterprise, and as tough as the iron they made. They lived and died by cast iron (one of them designed his coffin in it) and built an essential foundation on which our industrial development was to grow. There was a solid strength about it too. A quarter of a century after the birth of the Society the third Abram Darby constructed, with the iron from his own foundries, the first iron bridge over the Severn at Coalbrookdale, where it stands to this day. Industrial Britain was made in cast iron. The framework of the Great Exhibition was constructed entirely of cast iron when the yearly production of pig and wrought iron had

risen to about five million tons. But steel was still the expensive luxury of the Middle Ages.

Steel in abundance came from three very dissimilar men, Henry Bessemer, William Siemens and Gilchrist Thomas, who resembled each other only in their capacity to bring scientific knowledge and the scientific method to an age-old problem. The first fundamental invention was that of Bessemer, a born inventor and a man of science, who blew a stream of air through molten cast iron and reduced the carbon content without the lengthy and laborious process of puddling. He then went on in a series of large scale experiments, on a strictly scientific basis, using basically the same technique, to convert pig iron direct into steel in his converter, three years after the opening of the Exhibition. Siemens was an engineer with a sound training in academic science which led him to study the principles of heat exchange. Using the gas producer he had invented in 1861 he pre-heated the gas fuel with the hot chimney gases running to waste, and brought out his regenerative furnace in which higher temperatures were reached than were previously obtainable and at considerable economy. The way was then open to make cheap steel in bulk in the open, i.e. in an open hearth by decarburizing molten pig iron with iron ore. By far the greater part of the steel made in the world to-day comes from open hearth furnaces.

But neither Bessemer nor Siemens could overcome the obstacle set by phosphorus which induces brittleness in steel and which commonly occurs in most of the world's extensive iron ores. They were largely restricted to the use of non-phosphoric ores until the difficulty was overcome by Gilchrist Thomas, a clerk who learned his chemistry in the evenings at Birkbeck College and analysed the problem from the standpoint of the chemist. In the end the solution was simple —the oxides of phosphorus were removed from the molten steel by contact with dolomite bricks, with which Gilchrist Thomas lined his furnace. How simple great ideas appear when they have been thought out, formulated and demonstrated, but this single idea, logically pursued and practically applied, brought the whole world of steel-masters to our doors. Thus was a traditional industry transformed by three men of science, who had no previous experience of steel-making, and the world is now waiting for somebody who will turn iron ore straight into steel.

We have learnt, meanwhile, how to take the brittleness out of cast iron and to endow it with steel-like properties for a variety of new uses; and the alloying of steel with manganese, chromium, nickel, tungsten, molybdenum and niobium, has produced a variety of steels whose special properties in tensile strength, hardness, resistance to wear, corrosion and chemical action, have been invaluable to modern industry. In the air, space has become as important a consideration as weight, and bulky light alloys have given place to high tensile steel in the centre sections of the main spars of modern jet fighters. On the ground, the iron losses in transformers and other electrical machinery have been reduced by over eighty per cent in the past fifty years by the use of cold-rolled silicon steels.

Though the wax candle was in general use, gas lighting was well under way by the time the Great Exhibition was opened and the chemists were soon to deal

with the foul smell and the corrosive properties of the gas of the period by passing it through iron oxide to remove the sulphur. Subsequently, the German chemists took a hand. Auer von Welsbach made gas illumination strikingly effective with his incandescent mantle, and Bunthe, by introducing scientific methods of gas analysis and the idea of calorific value, was responsible for outstanding improvements and advances in the manufacture of gas. This was before the end of the nineteenth century and was among the first indications, as Liebig was soon to demonstrate more sharply, that we were not always going to have our own way in chemical or any other kind of technology.

Gas for lighting was originally a waste product in the coking of coal, yielding a by-product, tar, for which there were not many industrial uses at the time; but when Hofmann discovered benzene in tar and Perkin made a valuable textile dye from aniline derived from coal tar, it became evident that a great treasure lay hidden in tar, and the hunt was on. Perkin proceeded to make alizarin, another aniline dye, in 1886, but the industrial exploitation of synthetic dyes, for which there was a rapidly increasing demand from the textile industry, was left very largely to the Germans, who built up a flourishing organic chemical industry of great industrial and strategical consequence. First rate organic chemists grew up in the service of that industry and discovered not only that two other derivatives of coal tar, naphthalene and anthracene, hitherto considered of no value, were raw materials for new products, but step by step unlocked the treasure box which yielded wealth and power. And the industry gained in strength by the impetus it gave to the academic scientist who contributed so materially to the rise of organic chemistry. We took a hard rap, but after the First World War steps were taken which eventually enabled us to build up our own industry and make synthetic dyes at least as good as are obtainable elsewhere.

Coal replaced wood as a fuel and now it was the turn of oil. The discovery of petroleum in Pennsylvania in 1859 was of the utmost consequence in providing a liquid fuel for the internal combustion engine and opened up the revolution in transport that was to follow. It was also to produce a revolution in the field of chemical engineering and technology. The first process of refining petroleum in the United States was that of simple distillation based on existing techniques borrowed from the shale oil, coal tar and alcohol industries, but it soon passed under the influence of scientific research and under the control of the chemical engineers. The batch process gave way to continuous operation, using distillation columns and fractional condensation. The new technique of solvent extraction was introduced, followed by cracking to increase the proportion of the lighter fractions. We took little technical or industrial part in these developments. We had nothing but a little shale oil, and turned to coal to make petrol by hydrogenation either of the coal itself or of creosote, supplying about three per cent of our needs in 1939 when the hydrogenation of coal was abandoned. Our policy amidst all these advances in fuel technology was to depend very largely on the import of the refined spirit, and it is only since we switched in 1947 to the import of crude oil that a new feature of the utmost significance has entered into our industrial landscape. We have, as a consequence, saved roughly

the difference between the costs of crude oil and refined products on a consumption to-day twice as great as it was in 1939. We have built up a rapidly expanding export trade. Our imports of refined petroleum have dropped since 1938 by about forty per cent and our exports and imports of these products are now practically in balance. The investment of some £120 million (largely from grants or loans under the European Recovery Programme) has paid handsomely, and apart from the value of the fuel itself we find ourselves with a large new manufacturing industry making equipment for the refineries and a largely increased shipbuilding activity in building oil tankers, which accounted last year for more than half the tonnage launched from British shipyards. All this conforms to the only way we can earn our living—by importing raw materials and working them up into finished products which we can sell abroad.

The significance of this development in oil goes further than the provision of spirit for our motor cars and kerosene for our farm tractors (which have increased more than seven-fold since 1938) and diesel oils for heavy transport. The refineries are producing increasing quantities of fuel oil and residuals, opening up increased possibilities for relieving the pressure on coal. We should never lose sight of the fundamental fact that our competitors in the United States supply their productive workers with proportionally three to four times more electrical power than our own workers get, and an additional fuel supply for steam-raising or burning in gas turbines, or for any other purpose which might release coal for the power station, is all to the good. The use of fuel oil for steam-raising, central heating and furnaces, such as in the steel ingot, non-ferrous and pottery industries, has increased five times since 1938.

A further consequence is that new opportunities have presented themselves to the gas scientists and engineers who are at the moment operating a pilot plant producing town gas by the catalytic gasification of residuals. It is true that liquid fuels at present account for no more than ten per cent of our total fuel consumption, but we may have to look to oil to an increasing extent to supplement what coal we can get until nuclear energy techniques have advanced to a sufficient extent to enable a significant contribution to be made to our needs for electrical power. An atomic power station, based on a new type of atomic reactor, designed originally by scientists and engineers at Harwell, is being built in Cumberland. Plans are also laid for building a fast breeder reactor, which can be regarded in simple terms as a controlled atomic bomb. It differs from the earlier atomic piles in that new fissile material is produced concurrently with the generation of heat, thus enabling a very high proportion of the uranium charge to be used. The use of atomic reactors for power purposes involves the application and results of much pure scientific research and novel chemical technologies, and it is important that we master these new techniques to place ourselves in a position to supply power from this new energy source, and also to supply markets abroad which may grow to large dimensions before the century is out. We must invest in the future if we are to keep our place in the world.

We must invest in the future also in the manufacture of chemicals from oil, for it is likely that our organic chemical industry, which has hitherto been based

largely on animal oils, fats and coal, may come to rely more on crude oil and on by-products from the new refineries. We have made a start in this country during the past few years thanks to the determined pioneering of a small band of enthusiasts, but we have a long way to go to catch up with the 35 year old American petrochemical industry, which, it is said, now provides nearly a quarter of the total United States chemical needs, a proportion which is expected in ten years or so to increase to a half. The use of oil derived chemicals as starting points for new manufacturing products is rapidly increasing in the leading manufacturing countries, mainly for the wide range of synthetic rubbers, fibres and plastics, but including also industrial solvents and lacquers, detergents and pharmaceutical products. Very valuable products of this industry are butadiene and styrene, from which various kinds of synthetic rubbers are made. A particularly valuable type, known as butyl rubber, made from isobutylene, another petrochemical product, is far less permeable to air and far more flex resistant than natural rubber which it may be expected to replace in the making of inner tubes. Styrene is also the starting point for polystyrene, an insulating plastic with outstanding properties for the electrical industry, and the styrene-butadiene copolymer compounded with natural or synthetic rubber gives rise to a resin-rubber known as neolite, used to a very large extent in the United States in place of soling leather for footwear. There are also wide possibilities for the blending of plastics with synthetic rubbers for improving their processing and extrusion characteristics, their tensile strength, hardness and toughness. This new industry, a typical product of the century, born in the laboratory, nurtured by organized science, turned to practical account by the highest class of chemical engineering, will, in all probability, become one of the main activities of the chemical industries of the world. Through the manifold industrial uses of its end products a vast industrial complex is likely to come into being which we should endeavour to see reflected in our own industrial development.

Chemistry was a century behind physics in finding its fundamental concepts and establishing its basic principles. A hundred years after Newton had provided so firm and enduring a foundation for the physical scientist the minds of chemists were, in the eighteenth century, still under the spell of phlogiston—a medieval conception that even Priestley, who discovered the evidence to destroy it, never abandoned. It took a long time to die, but when Lavoisier put the pieces of the puzzle together, the chemistry of combustion was understood and empiricism, both in the laboratory and industry, had far less to say. The arrival on the industrial scene of Brunner and Mond, a hundred years or so after Boulton and Watt, was not a chance occurrence, but an event reflecting the history of progress of the two sciences. Both partnerships were similar in character, derived their power from the same combination of basic science, technology and business acumen, and produced the same kind of results. There were alkali works before Brunner and Mond as there were steam engines before Boulton and Watt, but both partnerships turned the industrial mentality from empiricism towards scientific thought and method; and towards the end of the

nineteenth century the small isolated chemical factories of the earlier days had been amalgamated and the pattern set for the large closely-knit organization commanding the power and resources for operations of the scale and scope to meet the economic demands of so many branches of industry. It made alkalis and acids for manufacturing processes, cyanides for extracting gold and silver, bleaching agents, mordants and dyes for the textile industry. The earliest records of the Society show an increasing concern about the large and growing imports of the madder plant for its pigment, but the problem was not to be solved for over a hundred years when the natural pigment was synthesized independently in the organic research laboratories in this country and in Germany.

About the same time the patient researches of Gilbert and Lawes at Rothamsted yielded a rich harvest from the understanding of plant nutrition, to which the chemical industry gave practical effect by the manufacture of ammonium sulphate, phosphates and nitrates, adding new power to agriculture, to be further increased in the course of the following century by the discovery and manufacture of insecticides and selective weed killers. It was to invade the field of medicine also and to bring untold benefits to millions, first by its manufacture of antiseptics and later, in this century, through the exploitation of the brilliant work of the organic chemist in synthesizing complex compounds, in the manufacture of drugs of decisive importance such as the sulphonamides, 'Paludrine' and 'Antrycide'. Nor was this all, for the discovery of vitamins by Gowland Hopkins, the revelation of the secret of hormones, and the ability to synthesize them, created a vast new power to influence vital processes on which health so largely depends. This story is by no means at an end for when Weizmann, at a critical period of the First World War, discovered a micro-organism capable of making acetone and butyl alcohol out of starch, and used the brewers' vats to make acetone on a large scale, he not only saved the day but foreshadowed the coming of industrial microbiology. This new industry has already yielded the rich prize of antibiotics such as penicillin, streptomycin and aureomycin. The seed that produced this luxurious growth was Pasteur's revelation of the nature of alcoholic fermentation, and the resources of the geneticist to bring into being new varieties of organisms, adapted to particular needs, may perhaps bring about the same kind of revolution in industrial microbiology as has been seen in agriculture through the selective breeding of animals and crops.

When the building of the Great Exhibition was moved to its new site the Crystal Palace gleamed with a thousand electric lamps. Both Edison and Swan had found out, each in their own way, how to make fine threads of carbon and raise them by an electric current to incandescence in a vacuum bulb. This achievement, by creating a large commercial demand for electricity, turned the electromagnetic discoveries of Oersted and Faraday into power stations, and the new force of electric power was brought into factories and homes. The carbon bulb, however, was responsible for much more than this. The blackening of the lamp led the curious scientist to wonder how it came about, and when the cause was tracked down to the emission of electrically charged particles the

idea of the electronic valve was born and the magical tale of radio, radar and television was, before long, to unfold itself. The carbon lamp was the Aladdin's lamp of the nineteenth century. Rarely has a single piece of scientific ingenuity been the cause of so profound and far-reaching an effect on the lives and habits of people the world over.

Nor have we seen the last of it, for the electronic valve has made possible in the last few years the automatic electronic computer which can perform in a matter of minutes calculations which would take a trained mathematician months, assisted by the conventional desk calculators. Its use is already becoming widespread not only in research, but also in many industries and activities where the burden of technical computations is absorbing the time of large numbers of computers in dealing with such varied matters as the pressure distribution over aircraft wings, ballistic problems, traffic studies and the reduction of data for weather forecasting. These are only a few of the many uses of the electronic computer which are either in practice or in sight. But its possibilities go further and strike deeper. Because these electronic machines can receive coded information and store it on a vast scale, and are able to digest and disgorge it in a suitable form according to coded instructions, they are capable of carrying out not only all the arithmetical operations of accountancy, but also a great variety of other routine clerical operations. Their coming therefore foreshadows the redundancy of much of our present-day clerical labour and brings the possibility of the electronically mechanized office sharply into the foreground. We may be witnessing here the beginnings of as much a change in taking the drudgery and the human fallibility out of clerical labour by electronic machines as has been achieved by the mechanical machines in the field of manual labour.

Before we have finished with the social and economic consequences of the machines of the eighteenth century we are being overtaken by new problems created by the advance of science in this century, striding ahead with scant regard for the ideas, institutions and organizational concepts it is leaving behind. The plain need for administration and management trained to be aware of and understand scientific achievement, if it is to be exploited for social and economic good, cannot be left to look after itself. The old complaint of the scientist failing to make himself understood has a double edge. Those who complain loudest often trouble least to understand. Managements which have both the training and experience to meet the needs of the times understand readily enough, and understand further that it is no longer sufficient to 'whistle up' science when they run into trouble. Applied science and manufacture require to be brought under the single command of a 'combined operation', to borrow a term from warfare where a similar evolution in practice has been dictated by necessity. War is a hard teacher. Peace is more indulgent, and the penalties of neglect take longer to show. But they show in due course in the balance of payments when foreign currency we can ill-afford has to be provided to buy goods we could make ourselves, or to acquire patent rights on processes we could develop in this country. Some think it is cheaper to buy patents from abroad than to run

research laboratories. It may be, but it is also the lazy road to decay. The proportion of manufactured goods finding their way into the increasing international market has not changed appreciably for many years, but their character has changed very considerably. There has been a steadily increasing trend towards manufactured products of the newer technologies and we cannot afford to fall behind others in the invention of new processes and the making of new products.

The needs of this century in manufacture go beyond technology and sound workmanship, and demand, in addition, imaginative design. We have travelled a long way since the early days of the Society when our furniture carried the mark of the artist and many articles of domestic use were characterized by a fitness of design whose reputation extends to this day. It appears, however, to have been too readily assumed that the machine and the commonplace go hand in hand and that if people get the benefit of abundance they must put up with the commonplace in design. But one has only to call to mind the beautiful machine-made fabrics such as those used for decorating the Abbey for the Coronation, examples of mechanized products in pottery and furniture, and other notable exceptions to the spate of characterless products which the machine inevitably turns out when unintelligently directed, to realize how false the assumption is. The truth is that such high levels in precision and quality control can be reached in manufacture that trained imaginative minds will find far more new ways of creating beauty than already exist for perpetuating ugliness. The social value of good design is in itself a matter of importance, but we have also a strong material interest in developing contemporary design standards to match our new techniques of production and of a quality that will promote the sale of our goods abroad. The balance of payments is not a new thing, but it is a new problem. We used to have things very much our own way but circumstances have changed. We are now playing against the wind and against those who, coming in late, were compelled to study the strategy of the game, embark on intensive training, and develop the will to win if they were to challenge our victories of earlier days. Twice in this century we have had to fight for our lives and we are now fighting for the means to live. We are in for a rare tussle for the rest of the century, and the outcome will depend, in a large measure, on our skill in using our human resources, on the training we are prepared to give and undergo, and on the thoroughness we bring to our purpose.

THE CHAIRMAN: I am sure you will wish me to express our thanks to Sir Ben Lockspeiser for a very brilliant lecture. He referred to the old complaint that scientists could not make themselves understood but he has proved that he at any rate has been able to make himself understood by a beautiful and wonderful lecture, which even I could understand. I think he has been absolutely marvellous and I am sure that when the corresponding lecture to this one is given a hundred years hence, the name of Sir Ben Lockspeiser will be referred to amongst all the famous names which he has mentioned to-day. I ask you to give him a hearty vote of thanks.

The vote of thanks was carried with acclamation, and the meeting ended with tea in the library.

III. COMMERCE

By SIR GEOFFREY HEYWORTH

Chairman, Unilever, Ltd.

The Earl of Radnor, K.C.V.O., Chairman of Council, in the Chair

Thursday, 25th March, 1954

THE CHAIRMAN: This, to-day, is the third of three lectures which are being given in commemoration of the Bicentenary of the Society, and which follow our full title, 'The Royal Society of Arts, Manufactures and Commerce'.

It was the wish of the Council that I, as its Chairman, should take the chair at all three. Unfortunately circumstances prevented me from doing so, but I am glad to say that I am able to take the chair on this occasion. One thing I should say and that is that I am quite certain that those three lectures will be a most valuable part of the records of our Bicentenary celebrations. I hope everyone will realize that these lectures are an integral part of these celebrations and they not only gather together in themselves what has happened in the past but they look forward to the future.

Now our lecturer this afternoon is Sir Geoffrey Heyworth. He is going to talk to us on the subject of commerce in the past two hundred years and he has, I understand, limited his talk very largely to the question of education in commerce and I would commend that very much indeed because, as we who are concerned with the Royal Society of Arts know well, education is one of our major activities to-day. Sir Geoffrey himself is a man who, I think, is eminently suitable to talk to us on this particular subject. Any man who has been the Chairman of Unilever, one of the greatest commercial organizations certainly in this country and probably in the world, for the last twelve years, can surely talk with authority on anything connected with commerce and more particularly with the question of education in commerce.

I do not propose to embarrass Sir Geoffrey unduly by saying too much about him. I would say this: that we do very sincerely welcome him here and I am quite certain that what he has to say to you will be of great interest and value to the Society and will be an extremely valuable contribution to our Bicentenary celebrations.

The following lecture was then delivered:

THE LECTURE

When that unknown Northampton drawing master, William Shipley, came to London to start this ancient and learned Society in 1754 Britain was already on the threshold of the Industrial Revolution. He and his co-founders realized instinctively the need to encourage both singly and jointly the arts, manufactures and commerce. The factory system was already beginning to supplant the inspiration of the craftsman, and a fresh incentive was needed to stimulate artistic achievement. This Society provided that incentive.

The two hundred years covered by this Bicentenary embrace what is perhaps the most potent period of world economic development in the whole history of mankind. Man's inventive powers were unleashed to improve the material welfare of the people. The steam engine provided new methods of motive power for industry and for commerce. It enabled new continents to be opened up, new goods to be produced and exchanged. It was a period of commercial expansion

The Lecturer

on an unprecedented scale and, unlike earlier times, the goods entering international trade were for everyday use and affected all classes of the community This made countries interdependent and that interdependence increased both the scope and the need for commerce.

It would be impossible, in the time at my disposal, to review historically the full development of commerce during the past two hundred years, so I intend to concentrate on one particular aspect of it, on the development of commercial education—the training of the mind to carry out efficiently the various types of work in commerce. I have chosen this aspect not merely because I am personally interested in it, but also because it is a subject dear to this Society, which after all was the originator of commercial examinations and which still holds a foremost position in that field.

The past two hundred years have witnessed Britain as the foremost commercial power, a position it had already won by 1754. They have also witnessed the rise of formidable commercial rivals, in particular Germany and the United States. And finally they have witnessed the passing of the economic leadership of the world across the Atlantic to our American cousins. During this period there were three important developments in commercial education—three strata each superimposed on the other and each constantly expanding over time. The first and

basic one was the growth of general education; commercial studies could not begin until people had been made literate and taught the three R's. The second was the introduction of commercial instruction as we know it now, starting first with bookkeeping and shorthand, and later typing and the professional studies such as accountancy, banking and insurance. This was training the commercial 'technicians'. The third and final stratum was the infiltration of commercial studies into the universities and the improved social status of commerce.

For the sake of clarity, I have divided the factual survey of these two hundred years into three broad periods. Although the dates delimiting each period are significant both in terms of general economic development and in the history of commercial education, I am fully conscious of the danger of trying to force historical processes—which are necessarily gradual and overlapping—into neat watertight compartments. But the periods I have taken correspond approximately to three main stages in British economic development and also to the emergence of the three different stages in commercial education.

1754–1851 THE THREE R'S

My first period extends from 1754 to 1851, and, as far as economic development is concerned, it covers what is generally referred to as the Industrial Revolution and the time when Britain was the leading commercial and industrial power of the world. It also coincides broadly with the development of general education—the first or basic stratum.

Educational facilities existed, of course, well before 1754. In the middle ages our two ancient universities, Oxford and Cambridge, and some of our great public schools, were started to provide education mainly for poor scholars studying for professional life as then understood. These institutions were never intended to be the preserve of the rich, though that is what they subsequently became; it is only recently that ability rather than wealth has once more opened the door to the universities. The monasteries too were seats of learning, and they, together with the universities, provided a supply of scholars, some of whom acted as clerks. This early beginning of what might be considered professional or even commercial education was lost as Latin ceased to be the universal language. Then, with the dissolution of the monasteries, education was secularized and subsequently became the responsibility of the parish, a responsibility that was seldom gladly accepted.

In the eighteenth century primary education was haphazard and illiteracy was high. Children went either to a parochial 'Dame' school or to a charity school (founded by an individual or a society). Or they might not have gone to school at all, for education was purely voluntary. The teaching seldom went beyond the three R's, though some workhouse schools attempted to provide training for a trade to fit their pupils into the existing apprenticeship system.

However effective this system of education might have been in the early part of the eighteenth century, it was inadequate to cope with the social problems of the Industrial Revolution, especially the increase in the juvenile population. The rise of factories in the industrial north provided ample opportunities of

work for illiterate children and both parents and employers took advantage of it. By the end of the eighteenth century the only real chance to teach the majority of children was on Sundays—an opportunity taken by Raikes when he introduced the Sunday school movement into England in 1780. Within twelve years half a million pupils were attending Sunday schools, and, although their education could not have amounted to much, it helped to satisfy a growing need. The evening was another opportunity for schooling, but only for those who were not too exhausted by a working day of anything up to fifteen or sixteen hours. However, sundry evening schools were established by voluntary initiative and they could claim as their most distinguished pupil George Stephenson who, illiterate at seventeen, remedied this by evening tuition.

At the turn of the nineteenth century Bell and Lancaster more or less simultaneously began to use the monitorial system, whereby the teacher taught his brightest pupils who in turn taught the rest. This system had a great appeal since it enabled one teacher to instruct a large number of children. It was used in the schools of the National Society for Promoting the Education of the Poor, which was founded by the Church of England in 1811, and by 1831 its schools were teaching nearly a million children. According to the census of 1851, religious societies alone founded nearly ten thousand schools in the first half of the century.

Attempts were made by the Government to limit the abuse of child labour by a series of Factory Acts from 1802 onwards and provision was even made for the teaching of the three R's in working hours, but they were ineffective until the Act of 1833 established a corps of inspectors. In the same year the Government gave its first aid to education. A bill was passed permitting an annual expenditure towards the cost of school buildings. This was administered through the church societies. But, in spite of this help, the census of 1851 reported that only half of the working class children between the ages of three and twelve were at school.

Throughout this period the number of people who were taught the three R's grew, but very few received any other formal education. The only subject taught which could be called commercial was book-keeping. Although double-entry accounting had been first used on a significant scale in Italy at the end of the fifteenth century, it did not come into general use in England until well into the nineteenth century. It was expounded in England in a textbook by Peel, the Clerk to the Governors of Christ's Hospital, as early as 1569, and it was taught in various private academies in England from early days, especially in the Dissenters' academies in the seventeenth and eighteenth centuries. But although it was being taught in several Scottish grammar schools by 1750 it was virtually unknown in the English grammar school. Christ's Hospital was the exception: it provided specialized commercial education—navigation and book-keeping—and many of its pupils went into the Royal Navy or into the great trading companies. However, Charles Lamb, who was educated at Christ's Hospital and was later in the accountant's office of the East India Company, confessed that he could not make up or understand accounts.

Formal technical education originated in England with the Mechanics'

Institutes. The first one was founded by Dr. Birkbeck in London in 1823, and they spread rapidly all over the country. They were designed to educate the artisan in the evening, in the general principles of mechanical science, but it was soon found necessary to teach the three R's, as most artisans had no sound basis of general education. The institutes subsequently extended their curriculum to include such subjects as book-keeping and modern languages, and they came to be used increasingly by the middle class.

Secondary education in this period was even more defective than primary and it made much less progress. The grammar and public schools concentrated almost exclusively on the classics and religion. The most modern education came from the Dissenters' academies which were set up as a result of the Act of Uniformity of 1662. They taught such subjects as mathematics, history, geography and modern languages as well as the classics. By the Toleration Act of 1689 they were allowed to become part of the grammar school movement, and while they were still very important in the first half of our period—they can claim Malthus and Hazlitt among other distinguished pupils—they had mostly been absorbed by 1851. Unfortunately this meant a setback to modern subjects, and at the end of our period the teaching of history, geography, modern languages and science, was either ignored or rudimentary in the extreme. The public schools and grammar schools may have provided a good education for the rich and the gifted, but Matthew Arnold estimated that in the 1850's less than sixteen thousand children, or about one in every five hundred of the age group eleven to sixteen, were receiving any form of secondary education.

Our universities were also inadequate. Although four had existed in Scotland ever since 1583, only two existed in England before 1832 and only two more (Durham and London) had been established by 1850. They kept the torch of learning alight and produced some notable scholars, but the number of undergraduates was very small because secondary education was confined to the fortunate few. In any case the influence of the universities on commerce was negligible.

Yet, despite the appalling lack of systematic education in this country, Britain was able to invent, develop and exploit, new industrial processes and to achieve a level of economic prosperity that had been unequalled. Indeed, organized education did little more for commerce and industry than provide literate apprentices—and an inadequate supply of them at that. Brindley and Arkwright, for example, had little or no education; Wedgwood left school at the age of ten; James Watt, it is true, benefited from Scottish education, but George Stephenson, as we have seen, was illiterate at seventeen. Equally, industry and commerce had little use for education; they considered practical experience the only necessary qualification, and indeed the whole apprenticeship system was built up on this idea. In this period the basic functions of education were carried out in the workshop and in the office rather than in the school.

Experience however was different in other countries, particularly in those two which were later to become Britain's rivals—the United States and Germany. Neither of them began their major economic development until after 1850,

but both made great strides in general education during the first half of the nineteenth century.

American primary education developed along lines similar to England up to 1825, but in the United States the cheapness of monitorial schools tempted many states to open schools on these lines. Although the system fell out of favour after 1830, state intervention in education had already become an accepted principle. A long battle was fought for free state schools and was won by 1851, at least in theory. In secondary education the grammar school was challenged and defeated by the academy, which offered modern subjects such as science, history, book-keeping, and anything else that was considered useful by the public. In 1850 it is estimated that a quarter of a million pupils were attending the private academies. This figure may not be very accurate, but it presents a remarkable contrast to the sixteen thousand receiving secondary school education in England at that time, especially as the population of both countries was roughly the same.

In Europe the roots of universal education were planted even earlier than in the United States. In Prussia, the State promoted education throughout the eighteenth century and while none of its educational measures was really effective, they prepared the way for the subsequent development in the early nineteenth century. In 1806 the humiliation of the utter rout of the Prussian army at Jena stung the State to develop education as a means of restoring the country's greatness. A full state system of education was made effective for all children between the ages of six and fourteen, and the teaching was based not on the monitorial system used in England and America but on the ideas of educational reformers such as Pestalozzi, which emphasized the individual. Secondary schools were organized as *Gymnasien*, *Bürgerschulen* and *Realschulen*. The *Gymnasien* gave a thorough classical education, while the other two taught mainly modern subjects and provided a first-class basic education for commerce. By 1856 Prussian secondary schools had about sixty-six thousand pupils or more than four times the number in secondary schools in England, although the population of Prussia was about two million smaller.

Thus, by 1850, although Britain was leading the world in the realms of manufacturing and commerce, it was lagging sadly behind its growing competitors in the provision of general and commercial education. In 1841, for example, less than sixty per cent of the people in England could sign their names in the marriage register, while in the United States the proportion was eighty per cent and in Germany eighty-two per cent.

1851–1913 THE RISE OF COMMERCIAL EDUCATION

My second period runs from 1851 to 1913. During these years Britain was no longer alone in the commercial field. France, Germany and the United States, made rapid progress in industrialization, drew level with and, in many branches, surpassed Britain. At the Paris Exhibition in 1867, for example, of the ninety representative branches of industry, Britain excelled in only ten. And this was just sixteen years after the Great Exhibition in London, which was originated by

this Society, when Britain was pre-eminent in nearly every one of the one hundred classes of goods displayed. The unquestioning complacency of the 1850's was rudely shaken; export markets were being taken away from British merchants. The Great Exhibition of 1851 had stimulated Britain's competitors more than Britain itself, and it was generally held that this lapse was due to our lack of technical education. People could point to Germany and the United States as examples of what could be done to train people for industry and commerce.

But before commercial training could be effective, it needed a proper foundation of general education and this did not come in England until after elementary education had become general in 1870 and compulsory in 1876. (In Scotland the beginnings of compulsory education can be traced back to 1494.) Commercial interests were active in promoting these two Acts, but it was still thought that the only education necessary for commerce was the mastering of the three R's—the rest could be learnt in the business. Even the teaching of book-keeping fell into disrepute—because it was said that there were so many different systems of accounting that it was not only useless but even harmful to learn one at school. This attitude was also applied, though with much less justification, to the teaching of shorthand.

Nevertheless this period saw the beginning of the second stratum—the provision of what I shall call 'technical' commercial education—the training of 'technicians' for commerce, from the shorthand-typist to the accountant. Although these commercial studies were too narrow and were superimposed on a still inadequate basis of general education, they were the beginning of formal commercial training. The Society of Arts was the pioneer of examinations in commercial and technological subjects. In accordance with its general policy, it encouraged others to take over where it had pioneered. The Government Department of Science and Art became responsible for the science examinations and the City & Guilds of London Institute for those of technology. But there was no organization to take over commercial subjects, so in 1882 the Society decided to concentrate on them alone. From 1876 they had included shorthand, political economy, commercial geography and history, in addition to book-keeping and modern languages—and, from 1891, typing.

The expansion in commercial education during the last decade of the nineteenth century and the first decade of the twentieth can be seen from the number of papers worked in the Society of Arts' examinations. In 1890 there were approximately two thousand five hundred, in 1900 ten thousand, in 1905 twenty-four thousand, and in 1913 over thirty-three thousand. A similar growth can be seen in the number of entries for the certificates of the London Chamber of Commerce which started examining in 1890. These rose from a hundred in 1895 to over eleven thousand in 1910. In the Society's examinations, book-keeping accounted for over a third of the papers even in 1913, but shorthand and typing were also becoming important. This rapid increase in examination entries shows that commercial education was being provided somewhere, since neither the Society nor the London Chamber of Commerce held classes of their own.

The real expansion in commercial studies began in the 1890's and it was no doubt aided by the intense competition that Britain was meeting in overseas markets, especially from Germany. The Royal Commission on Depression in Trade and Industry reporting in 1886 stated that 'in every quarter of the world the perseverance and enterprise of the Germans are making themselves felt. In the actual production of commodities we have now few, if any, advantages over them, and in the knowledge of the markets of the world, a desire to accommodate themselves to local tastes and idiosyncracies, a determination to obtain a footing wherever they can and a tenacity in maintaining it, they appear to be gaining on us'. Part of the reason for this had been pointed out by the Royal Commission on Technical Education a year earlier, which criticized the lack of not only technical education but also the 'ordinary commercial instruction which is needed in mercantile houses'. Indeed the inferiority of the British clerk was so apparent that many merchanting firms employed German-Swiss clerks especially for their command of foreign languages. Earlier than this there had been developments which later assisted commercial education: a modest form of government help had begun in 1853, when the Science and Art Department was instituted to establish and make grants to science and art schools all over the country. The Government had also encouraged the establishment of continuation schools—elementary day schools which held evening classes. The latter were initially restricted to the three R's and some eighty thousand students were attending these classes in 1870. Commercial subjects were introduced in the late 1880's and these schools became the predecessors of the junior commercial and technical schools.

Another important milestone was the City of London Parochial Charities Act of 1883. As local charity funds were no longer needed for their original purposes, this Act allowed the moneys to be spent on education. In this way the Polytechnic in Regent Street, which had been opened by Quintin Hogg in 1882, was endowed. Other technical institutions also profited from it. But large-scale financial aid had to await the Technical Instruction Act of 1889 and the Local Taxation (Customs and Excise) Act of 1890. The former empowered local authorities to finance technical education out of the rates; the latter provided them with financial resources in the form of 'whisky money' (the proceeds of a duty on whisky). In 1901 out of £1 million of public money spent on technical education, over £850,000 was 'whisky money'. Under these new powers local authorities set up a number of technical institutions, many of which offered commercial subjects, as well as continuation schools wholly dedicated to commerce. The Education Act of 1902 put the responsibility for all forms of education (other than university) on the local authorities. Rapid progress resulted, both in the provision of general secondary education and of evening schools for technical and commercial teaching. The first commercial course was introduced by Manchester before 1900. But although this idea spread, and was adopted by London in 1913, it was never popular with students and commercial education remained largely a matter of instruction in individual subjects, which limited its effectiveness as a means of broadening the mind.

Before leaving the clerical side of commercial education, I must say a few

words about shorthand and typing. Isaac Pitman introduced what is generally considered to be the first modern shorthand in 1837 and through his school, through lecture tours, through correspondence courses, and finally through his publications, he gradually made people aware of the usefulness of this form of writing for commerce. His correspondence courses were much aided by the introduction of the penny post in 1840, which enabled his penny sheet of shorthand to be delivered for a total cost of twopence. In 1870 he founded a college for commercial subjects, principally shorthand. A considerable fillip to shorthand came from the international congress held in London in 1887, and by 1913 over a quarter of the papers worked in the Society's examinations were for shorthand, as opposed to only one-seventh for typing. For although a serviceable typewriter was on the market in 1875, typing did not become general practice until after the 1914–18 war, by which time touch-typing was firmly established.

During this period certain occupations connected with commerce began to acquire professional status. Institutes were set up which granted diplomas to those who passed their examinations. In that way they were able to maintain and raise their standards. These societies fall into three groups: first those started by the 'technicians' themselves as a means to improve their own status; secondly those started by employers to ensure a supply of qualified personnel, and thirdly those which were really learned societies designed solely to promote interest in a particular subject.

The actuaries were the first of the 'technicians' in commerce to form an institute and that was in 1848. They held examinations as early as 1850, though these did not really get under way until much later. The purpose of the Institute was 'to develop actuarial science, elevate the status of the profession, promote the discussion of business problems and provide for the training of young actuaries'. And the status was to be raised by restricting the profession to only those who attained the standards laid down by the Institute. The syllabus for the examinations was technical and preparation was mainly by practical work and by reading papers and discussions published in the Institute's journal.

There had been a chartered society for accountants in Scotland since 1854. But in England the first association was not founded until 1870 and that was at Liverpool. Four others were subsequently established and they all amalgamated into the Institute of Chartered Accountants in 1880. The purpose was again to raise both the social and professional status of accountants and to improve their standards. Examinations were started by two of the original five associations in 1878 and they were continued by the Chartered Institute in 1880. These naturally encouraged the teaching of book-keeping and accountancy, and the training was and still is mainly technical. The Chartered Institute has never had the same degree of control over its profession as the Institute of Actuaries, because other associations were subsequently established—among them were the Society of Incorporated Accountants and Auditors in 1885, the Association of Certified and Corporate Accountants (an amalgamation of three associations founded between 1891 and 1904), and the Institute of Cost and Works Accountants founded in 1919.

The Institute of Secretaries, formed in 1891 and chartered in 1902, was another attempt by a group of experts to acquire professional status. It held its first examinations in 1897 and required a fairly general commercial knowledge for its intermediate stage. Its syllabus included economics, statistics, the principles of banking and finance, and mercantile law. The Incorporated Secretaries Association was founded in 1907 but subsequently amalgamated with the Chartered Institute. The latter's only rival now is the Corporation of Certified Secretaries established in 1922.

Two examples of societies sponsored by employers are the Institute of Bankers and the Chartered Insurance Institute. The Institute of Bankers was established in 1879, and its purpose was to raise the efficiency of bank employees; bonuses were paid to those who passed its examinations. From the beginning its syllabus was general, the intermediate stage covering economics, commercial geography, the practice and law of banking and a modern language. The Insurance Institute was formed in 1873 (and chartered in 1912) but did not introduce examinations until 1899 and these were mainly technical.

Of the learned societies, I shall mention only two, the Royal Statistical Society founded in 1834 to 'prepare, arrange and publish facts calculated to illustrate the condition and prospect of society, as far as possible facts which can be stated numerically and arranged in tables', and the Royal Economic Society founded in 1890 as the British Economic Association for 'the general advancement of economic knowledge'.

As these professional bodies came into being and grew in stature, so the demand for the teaching of commercial subjects at a higher level was created. Though the societies usually provided lectures and bibliographies or even books, few of them did much to provide the necessary education for their examinations. By not sponsoring the idea of part-time day studies for the professions, they reinforced the evening school movement. The old institutions expanded their curricula and the new technical colleges made provision for professional studies where it was needed. In London the principal sources of professional education in the last decade of the nineteenth century were Birkbeck College (founded in 1823 as the Mechanics' Institute), the City of London College (1848), the Goldsmiths' Institute (1891), and the various polytechnics which were then being established, and all of them concentrated mainly on evening tuition. Universities were beginning to get interested in this field, but I shall discuss their development more fully in the next period.

In contrast to Britain's concentration on evening schools, full-time education in both commercial and technical subjects was standard practice in most other countries. In Germany a network of post-elementary commercial schools was developed after 1850. These varied from lower commercial schools for apprentices (before and after their work) to higher commercial schools for pupils up to seventeen years of age or even twenty. A large proportion of people entering commerce had received full-time education up to the age of eighteen or even higher, whilst in Britain only a few had received this after the age of twelve. Higher commercial education in Germany came from business schools of

university status which developed separately from the universities. The first was at Leipzig in 1898 and two more followed in 1901 at Cologne and Frankfurt. By 1913 there were two thousand six hundred students at these commercial colleges, quite apart from an almost equal number doing economic subjects in universities.

In the United States commercial education developed fast, both through the state high schools (with a normal leaving age of eighteen) and through private business colleges. The growth of business teaching in high schools was mainly at the end of this period. For example, a report of the Commissioners of Education estimated that in 1893 fifteen thousand pupils in high schools were receiving education in commercial subjects, whereas by 1917 the number had risen to nearly a quarter of a million. The United States was also the pioneer in higher commercial education: the Wharton School of Finance and Economy of the University of Pennsylvania was founded in 1883 and from 1898 onwards, one university after another introduced a school of commerce—Harvard even introduced a post-graduate course in 1908.

1913–54 THE UNIVERSITIES

My third period extends from 1913 to the present day, and its main features include the upheavals of the two world wars and the subsequent rehabilitation, the Great Depression of the 1930s, the expansion of overseas markets, and above all the rise of the United States to its present position of economic dominance of the western world. Events in this period are too recent for us to be able to see them in true historical perspective, so I shall do no more than comment briefly on those developments in education for commerce which at the moment seem to be significant.

This period coincides roughly with the entry of the universities into commercial education—our third stratum. But before we discuss this development, let me first outline the further growth in our two other strata. During this period secondary education became compulsory under the Education Act of 1944, and entry to universities was widened so that now it is limited only by space and ability. Before this the local authorities, which had been given wider responsibility for education in 1902, had awarded grants and scholarships on an ever increasing scale, so that more and more students had passed from the elementary schools to the grammar schools and on to the universities. Many grammar schools had introduced a one year commercial course for students of fifteen to sixteen and an advanced course in modern subjects, including commercial ones, for the sixteens to eighteens. But this was still general education, though with a commercial bias, rather than commercial training.

For those who could not get into grammar schools, other schools giving a mainly vocational training were provided. Under the 1944 Act these were brought into the comprehensive secondary school system as secondary technical and secondary modern schools. Although they provided day-time instruction in commercial subjects, the number of students receiving it was relatively small. Most of the commercial instruction throughout this period was in fact done in

evening classes and by correspondence courses. The Fisher Act of 1918 fostered the co-ordination of further education in England by introducing a system of evening instruction in technical colleges and institutes on three different levels, junior, senior and advanced.

Recently the system of daytime release for further education has made inroads into the monopoly of the evening schools. But even in 1952 eighty-four per cent of the students enrolled in institutions of further education were evening students, with fourteen per cent part-time day students and two per cent full time. I cannot give an exact breakdown for commercial and professional students only, but the preponderance of evening study is probably even more extreme, because in this field the system of daytime release is not used on any significant scale.

The origin of the correspondence school movement was probably Isaac Pitman's twopenny shorthand sheet in 1840, but its major growth did not begin until after the First World War. Since then these schools have become an important influence in the development of technical and commercial education. They cover all branches of study, including preparation for external degrees, and their growth can perhaps be regarded as a measure of the inadequacy, or at least the inconvenience, of institutional teaching. Correspondence teaching is particularly important in preparation for the examinations of professional bodies, where it is estimated that between sixty and eighty per cent of such students use them. No figures exist giving the total number of students using the correspondence schools. But the largest of them claims to have over one hundred thousand enrolments a year, so that the total for the country is probably of the order of a quarter of a million.

Since 1913 the number of professional, semi-professional and other organizations has multiplied, but very little effort has been made to co-ordinate the examination requirements within each profession. Such diversity has made it extremely difficult for the technical colleges to provide appropriate courses. This left the field open to the correspondence schools. The management institutes, which also roughly date from this period, are however the exception. They were brought together in 1946 by the Ministry of Education and they subsequently agreed in the words of the Urwick report 'that all management professional institutes should adopt a common curriculum for intermediate courses'.

One of the most regrettable features of commercial education in England, has been the failure of the grouped course in commerce. This can be seen both from the details of the papers worked for the Royal Society of Arts and from the lack of progress of the National Certificate in Commerce, which is designed as a course and not as a group of subjects. Of the one hundred and thirty-five thousand papers worked for the Society in 1953 (a fourfold increase since 1913) over eighty per cent were in the single subjects, mainly shorthand, typing, and bookkeeping. And this experience is probably typical. The National Certificate, which has succeeded so well in many fields, notably engineering, has never become popular in commerce. In 1952 it accounted for only three hundred and twenty out of a total of twenty-two thousand entries for the ordinary

grade. This has been partially due to the insistence of employers on 'professional' certificates and to the refusal of the professional institutes to grant any significant exemptions to holders of the National Certificate in Commerce. But equally important perhaps is the difficulty of following such a course on top of a day's work. It is the limitations of evening study, whether at evening schools or by correspondence, that have encouraged this concentration on single subjects and made so much of commercial education narrow and technical, and thus to be condemned on general educational grounds.

Although this period saw the institution of compulsory secondary education and a great expansion in commercial training, its most significant feature was the coming together of commerce and the universities. It is true that the infiltration of commercial subjects into the universities had started in the first decade of the century. For example, commerce degrees were instituted by Birmingham, Manchester, Leeds, Liverpool and Durham before 1913, though London did not introduce one until 1919 and Bristol until 1932. (Edinburgh instituted one in 1918.) But the real development did not take place until after the First World War. Nevertheless, even now the number of commerce degrees awarded annually is only about three hundred.

In addition, there was the introduction of economics courses. The London School of Economics, founded in 1895, has been in the forefront of this development. Cambridge initiated a full economics course in 1903 and while Oxford has never permitted a specialist degree in economics, the P.P.E. course can be tilted towards economics at the expense of politics and philosophy. However, in England and Wales the total number of degrees that could be described as business degrees (including economics) is still not more than a thousand a year. This compares with fifty thousand degrees awarded annually in the business schools of the American universities. Further, post-graduate courses in business subjects, which have been highly successful in the United States, have failed miserably in England. In 1930 the London School of Economics established a Department of Business Administration to provide the only proper post-graduate business course in this country, and the number of students is still less than twenty a year. This failure has been due partly to the lack of support from industry and commerce, where many firms still regard post-graduate work as a waste of time.

The large number of business degrees in the United States is a reflection of the high social status that business has always enjoyed in that country. Until the beginning of this period, graduates in England went into the Civil Service or the professions rather than into industry or commerce. Since then, however, there has been a marked change. Commerce has in fact become respectable—and its new respectability made it worth considering as a career for the university student whatever his subject. Further, as universities ceased to be the preserve of the rich, they included more and more students who had no inhibitions about entering commerce.

Even though the commerce degree may be regarded as a failure, in that it has few friends among either students or employers, a close link now exists

between commerce and the universities. Commerce has had to rely increasingly on the universities for its recruits, and most of the graduates it has engaged have probably not taken commerce or economics degrees. Likewise the universities have had to rely increasingly on commerce as an outlet for their graduates. Indeed, this interdependence is being accentuated nowadays by the growing number of pupils going to universities under the new educational system, and by the consequent decline in the number and quality of pupils finishing their education at the secondary level. This drawing together of commerce and the universities was no doubt initially helped by the introduction of commerce degrees, but the real impetus came from the change in social outlook that took place after the First World War.

Before leaving higher commercial education, may I be permitted to mention a development which technically falls outside my main subject but which is nevertheless particularly relevant to it? I refer to the new 'post-experience' courses.

These cover the twelve week full-time course at the Administrative Staff College at Henley and the experimental full-time or part-time courses at Oxford, Cambridge and other universities run in collaboration with industry. Similar courses are also organized by the banks, who have been pioneers in this movement, the British Institute of Management, the West Riding County Council, and by individual industrial and commercial concerns. The latter courses are usually run in conjunction with management training schemes within the firms.

The Henley Staff College was founded in 1946 on private initiative, and is financed by industry and commerce. The course is intended for men and women of considerable experience (the average age is usually just below forty) and here the emphasis is on exchange of experience by a subtle blending into syndicates of individuals from different occupations, rather than on formal teaching by lectures. Over a thousand have already been to Henley and they constitute a leaven which in time will exert a considerable influence in both industry and commerce. The other courses are generally organized for somewhat younger age groups.

THE FUTURE

This historical survey leads us to the conclusion that there has been no obvious direct causal relationship between the growth of commercial education and the growth of commercial prosperity. It was no doubt true that German success in commerce in the late nineteenth century was due, partially at any rate, to the availability of well trained personnel. Similarly it can be argued that the high rate of productivity currently achieved in the United States is in part due to the systematic training of young business executives. On the other hand, in the second half of the eighteenth century and the first half of the nineteenth, Britain became the foremost commercial and industrial power without the help of education and when most of its inventive geniuses had barely ceased to be illiterates. Admittedly at that time there were no other countries that could have challenged Britain. France was in the throes of a revolution; Germany was still a

collection of warring states; Russia had not yet emerged from the feudal system; while the United States was only just born. Nevertheless it remains true that despite the lack or shortage of formal education, Britain managed to breed brain, character, enterprise and genius, and it trained its people the hard way by learning from the actual experience of life.

The process of economic growth is mysterious and contains elements which defy analysis—the spirit of adventure, the waywardness of fortune, the fertility of the mind. Hence the lack of causal correlation between commercial prosperity and the adequacy of education should not surprise us, for a multitude of factors are involved, each of varying significance over time. Education is just one of these factors.

But this is not to argue that education or even commercial training has no important contribution to make. During the past two hundred years the international exchange of goods and services has become a highly complicated affair requiring skilled knowledge in a host of different subjects such as tariffs, marketing, banking, insurance and so forth. If a firm or a country is to be successful nowadays in the growing competitive struggle for markets, it must have first-class technicians at its disposal. But technical studies, which are essentially the acquisition of a particular and concentrated knowledge, are inevitably specialized and thus often fail to train and broaden the mind. If, therefore, our commercial technicians are to be provided with the necessary adaptability, breadth of vision and ability to think logically even when they have to go outside their own subject, then their specialized studies must be superimposed on a wide education.

The purpose of education is essentially threefold. First to get people to think clearly, to appreciate accurately and to express themselves simply and succinctly; secondly to pass on accumulated experience so that all can learn from the success and failure of others; and thirdly to help mould the character. As mental abilities differ greatly, it is necessary to have educational institutions at various levels, but at each level the basic purpose of education is the same. The difference should be only one of degree. This applies particularly to our universities, which should above all be concerned with teaching students to think and to acquire a personal intellectual discipline. Unfortunately in recent years universities have tended to concentrate more on injecting knowledge into students than on helping them to develop their own faculties. This applies to all subjects including commerce, but commerce at any rate needs trained, disciplined minds as much as knowledge.

I do not wish to suggest that universities should leave commercial subjects alone, for these help to provide a form of business experience. It is fundamentally not so much a question of the size of the curriculum, or indeed what subjects are taught, as how they are taught. Even the most technical subject can be used as a means of training and broadening the mind, if it is taught well. But since teachers also differ in ability, it is wiser to rely on a wide syllabus involving a number of different teachers, so as to provide pupils with a greater scope for mind training as well as with a more diversified experience.

The process of education does not necessarily involve technical instruction

(although, as I have already mentioned, technical instruction under ideal conditions could be a means of education). Yet under modern economic conditions we must have people who are technically well trained. This brings us to the central problem of modern education: how to find time and facilities for both a general education and a properly comprehensive technical training.

Commerce in particular requires character, brains, imagination and experience, in addition to the appropriate technical skills, and I think the solution here may well be to draw on the stream of education at three different points: from the secondary schools, from the commercial professions, and from the universities. Each intake would have been subject to a different degree of mental training. Each would have acquired a different accumulation of experience. Yet within one firm they would intermingle and with their varied backgrounds help each other in their common task. Such a system would ensure that the various requirements of commerce were met at all levels, and since it would enable the best of each intake—including those who develop late in life—to rise to the top, it should provide a flow of executive ability second to none.

It would be folly to restrict the intake into commerce to any one particular level. The essential thing is to get a proper blend—I might almost call it a proper cross-fertilization—of people with different standards of education and different types of experience. If people's minds have been well trained they will not only gain from business experience but also make their own contribution to it. In this, the development of the 'post-experience' courses can play an important role. They can be used by the larger firms to ensure that the different types of people can meet and exchange their individual experiences. They can also be used to exchange experiences as between different firms in the same industry and between different industries.

A solution of this kind would mean that those entering commerce from the secondary schools would have to be given an opportunity to pursue further studies. Here I do not think the evening school is the right answer. If a person has done an honest day's work he requires relaxation in the evening and not another period of mental effort. A better way might be an extension of the day release system still operated on a compulsory basis in Germany and on a voluntary basis in certain branches of industry in this country. Under this system young people would be released from work for, say, one day a week, or perhaps two half days, to continue their higher studies. If at the same time a general and fairly wide syllabus could be agreed upon—and the remodelled National Certificate in Commerce might form a good starting point—then at least there would be some scope for developing critical faculties as well as imparting knowledge.

This Society has always realized the intimate connection between the arts industry and commerce. The fulfilment of man's personality depends mainly on the arts, but these derive their material nourishment, in Britain at any rate, from a thriving industry and commerce. And, if commerce is to thrive, it needs the help not only of skilled technicians but also of men who are truly educated, with a strength of character, a will to work, a breadth of vision and a practical

determination. It is surely the task of education to equip people so that they can develop these powers in every field of human experience—and not least in commerce.

SIR HARRY LINDSAY, K.C.I.E., C.B.E. (a Vice-President of the Society): I have a double duty to perform this evening and a double pleasure in performing it. I want to ask you to join in a very hearty vote of thanks indeed to Sir Geoffrey Heyworth, who has read us such an admirable paper on the subject of education for commerce. How wise he was not to lose himself in the morass of general principles of commerce but to concentrate on a subject so dear to our own hearts at this Society. I often think, and in fact these thoughts were inspired by his address, that we human beings tend often to confuse means and ends. We look on education as an end in itself and we forget that education only serves its proper purpose when it serves an end greater than itself. The immediate end is the diffusion of knowledge but this too, if it is allowed to become an end in itself, becomes academic and withers away. The diffusion of knowledge must therefore in its turn serve an end still greater than itself and I suppose this would be described by different people as wisdom or character-formation, and wisdom again must serve an end greater than itself, and I can only describe that in one word as 'citizenship'—the service of humanity and the service of the community. Now all those thoughts have been brought out admirably by Sir Geoffrey in his address and they are particularly relevant to us in our celebration of our Bicentenary. We therefore owe him a very great debt of gratitude and it is a great pleasure to me to express that on your behalf.

My second duty is directed more towards our Chairman than to him. It is to ask you to join me in a very hearty vote of thanks to our Chairman. Lord Radnor has been the life and soul of our Bicentenary celebrations. I could have wished that he had signalized them, if convention had allowed, by wearing those robes which his distinguished forefather wore on somewhat similar circumstances at the birth of this Society. Instead he is wearing the Badge of Office presented by Mr. Jack Milne, a good friend of the Society. Our Chairman has won our admiration and affection for all that he has done and is doing for the Society. Will you please join in a very hearty vote of thanks both to Sir Geoffrey and Lord Radnor?

The vote of thanks was carried with acclamation.

THE CHAIRMAN: It falls to me to thank you for that vote of thanks. I did not realize that I was going to get one, but just before we came into the room our speaker this afternoon was informed that there was going to be a vote of thanks and he said, 'You don't want me to do anything more than smile in an embarrassed manner?' I hope he is doing that. I would say thank you on his behalf as well as on my own for what Sir Harry Lindsay has said. It is particularly nice of him to say it and, as always, he said it in a particularly nice way.

Before we conclude may I make a reference here once more to this badge that I am wearing, which is presented as you have been told by Mr. Jack Milne as part of these celebrations and of which I am very proud indeed?

The meeting then ended with tea in the Library.

GENERAL NOTES

THE AUGUSTUS JOHN EXHIBITION

By courtesy of the Royal Academy of Arts

An hour at Ower, Dorset : *one of Augustus John's panels, lent by Mrs. T. Cazalet-Keir*

The exhibition of over four hundred paintings, drawings, and recent bronzes, by Mr. Augustus John, covering a working span of sixty years, arranged by the Royal Academy in their Diploma Gallery, is a proper tribute to an eminent artist whose name has long been a household one in this country. It is, perhaps, fitting also that this review should appear in this particular issue of the *Journal*, for Mr. John's roots are likewise in past time, his earlier drawings rivalling those of Rubens and Watteau, and his etched portraits possessing in several instances the hypersensitivity and insight of Rembrandt's, as students in the B.M.'s Print Room must often have remarked. It is little wonder then that Professors Brown and Tonks, of the Slade School, should have regarded him as the most startling prodigy in a period of fine drawing; and small wonder either that Mr. John, inspired by his romantic ancestors and possessing at the same time so independent and impetuous a spirit, should have remained untouched by artistic convulsions, at any rate during the past forty years.

Though Mr. John's most devoted supporters might regard his large-scale decorations with mixed feelings, it seems nevertheless a pity that only one of these compositions has been retrieved—the improvisation called *Lyric Fantasy* of about 1911. The romantic beauties of this decoration, the delicate colour and poetic relation

between the figures and dappled Innes background, outweigh, I think, more than in any other of his huge fantasies, the inconsistences and seeming inability to carry the figures further. All round this room are drawings of Ida, the artist's second wife Dorelia and the children, drawings that early exhibit his absolute assurance and grasp of form, together with others like *The Lady in Brown* revealing that other-worldly, almost mystical aspect of his nature that has drawn him to kindred poets from Yeats to Dylan Thomas.

While Mr. John's earlier painting abounds with pastiches of Greco, Tiepolo, or Daumier, for a short while at Liverpool (about 1908–1909) he produced several old masterly portraits of the University dignitaries as sober as the portraiture of Watts, and without a trace of his later *bravura*. A portrait of *Professor Muspratt* in a scheme of silver, maroon, and dark grey, is among the most impressive of these; but, as if rebelling against the restraint, he painted the celebrated *Chaloner Dowdall* composition with a mingled wit, verve, and ceremony that he rarely afterwards compassed with such happy effect. In a few years after 1910 he also produced the ravishing series of panels of Dorelia, a willowy figure alone or with the children, posed often against the landscape of Martigues; and an array of these, painted with breadth and the subtlest colour harmonies, shows how wonderfully they have weathered. In these pictures it is evident that his friend Innes's intense and romantic vision of mountain country inspired him even more than recollections of Purvis, whose rapt mood is reflected, for instance, in *Notre Dame de Martigues*. Less expectedly, a painting as radiant and simplified as *Gipsy in the Sandpit*—from the Aberdeen Art Gallery—suggests that Mr. John was more responsive to French Post-Impressionism at this time than is generally supposed, while hints of Cézanne actually occur in later landscapes. Nevertheless it is true to say that since the First World War his painting has been virtually unaffected by any contemporary artist or movement.

That Mr. John's later portraiture has been more variable is manifest in the North Gallery, and it is much to the credit of all concerned that the more obviously indifferent performances have not been withheld. Clearly an artist so impulsive and self-reliant cannot conceal the fluctuations of inspiration, and the professional portrait painter must often have wearied of the succession of sitters in the 'thirties. Mostly the sitters are idealized, sometimes it might seem incongruously so, and much depends on the extraordinary expressiveness of the eyes. The artist's verve persists, and a portrait as ironically effective as *Brigit MacNamara*, clearly done *con amore*, or an occasional good flowerpiece, is still well within his grasp. It is too with evident relish that he has lately begun to perpetuate his intimates in bronze busts that reproduce the larger-than-life idealization of his painting.

Few have written of Mr. Augustus John with such delicate insight as Sir John Rothenstein, and few visitors, I fancy, after touring this impressive exhibition will be disposed to quarrel with the last words of his essay. 'If John's crowded annals have failures to record,' he concludes, 'in his inspired moments no living British painter so nearly approaches the grandeur and radiance of vision, the understanding of the human drama, or the power of hand and eye of the great masters of the past.'

NEVILE WALLIS

NOTES ON BOOKS

THE ROYAL SOCIETY OF ARTS. *By Derek Hudson and Kenneth W. Luckhurst. John Murray.* 30*s* (Price to Fellows, 25*s*)

Perhaps the pre-eminent feeling of the reader as he lays down this masterly account of the history of the Society will be of the strength which it has derived from unorthodoxy. How easy but fatal is it for any collection of eminent men to travel peacefully and gracefully along established paths, but how brief and different would

have been the history of the Royal Society of Arts if its members had succumbed to that temptation. The authors of this book bring out very clearly how the Society has always attracted the liberal minded. Among those who have left their mark in the proceedings housed in that splendid Adam building in Adelphi there is a notable absence of clergymen. It is true that the Society has owed much to the Reverend James Booth, who was Vicar of Stone in Buckinghamshire, but since he was presented to this living by the Royal Astronomical Society we can regard him as somewhat outside the ranks of conventional clergymen. It would be difficult to imagine Parson Woodforde or Archbishop Howley or indeed any typical product of the Oxford Anglican tradition feeling quite at ease among the company which thronged the rooms of the Society. 'Orthodoxy is my doxy' exclaimed Bishop Warburton, and it would probably be fair to say that the Society has always inclined to the other man's doxy as that divine explained the meaning of heterodoxy. The authors point out that in the field of medicine, 'beset by conservatism and controversy', the Society has always encouraged the expression of unorthodox opinions—such as Sir Aldo Castellani's account of the health of the Italian Army in their unprincipled onslaught on the Abyssinians or Mr. Edridge Green's theory of colour-blindness. The general reader, who happens to be unfamiliar with the Society's work, will likewise be struck by the work done to ameliorate industrial conditions. Possibly the most memorable side of this was the effort made to abolish the chimney 'climbing boys'; as early as 1806 an award was made of gold medals to a sweep who cleaned over 300 chimneys without boys and was a pioneer of rods and brush. Another similar effort towards improvement was the provision of public lavatories in London, which entertaining experiment is well described by the authors.

Against this history of pioneering adventure which has constantly animated the Society the reader will scarcely be surprised to learn that few men gave it greater encouragement than the Duke of Sussex. 'Little Suss' as Creevey affectionately called him, who has left his marginal comment opposite the Athanasian Creed 'I do not believe a word of it', who in his black skull cap honoured the first train between London and Birmingham with his company had that ardent pioneering spirit—that certainty of the progress of mankind—which this book well brings out as one of the principal ingredients in the history of the Society. In some measure the Society owed its survival, during a time of embarrassment, to the wise guidance of the Duke of Sussex, and it is not surprising that it was a Liberal Chancellor of the Exchequer, Mr. Gladstone, who stepped forward with an annual grant of £500 at another moment of difficulty.

The authors, as befits those recording the history of a great House (using that word in the old sense of a place of business), are uniformly kindly in their references to former members of the Society. One of the most illustrious Presidents of the Society was the splendid Duke of Norfolk who became a Protestant, only washed when he was the worse for liquor and was throughout his life a scourge of kings and governments. The readers will strive to agree with the comforting conclusion of the authors that the excessive drunkenness of their President was nothing worse than 'eccentricity'. Again, when they describe Sir Henry Cole's autobiography as 'characteristic', it would perhaps be fair to add that it is one of the dullest books in the language. An ebullient personality trying to be discreet is a painful exhibition of human nature.

Mr. Luckhurst and Mr. Derek Hudson have together produced a record of the Society which is in all particulars worthy of the story they have to tell, and of the body of men they wish to rescue from oblivion. Their story, though necessarily detailed, is told with masterly skill and should be read by all who wish to understand the intellectual growth of the inhabitants of these islands. Nor will the attentive reader fail to observe the technical skill and the admirable taste with which Mr. John Murray has produced their work.

ROGER FULFORD

FROM THE JOURNAL OF 1854

VOLUME II. *14th April*, 1854

TRADE MUSEUM

The following is an extract from a circular letter signed by Edward Solly, an ex-Secretary of the Society, published in the Journal for the information of Institutions in Union.

Sir,—Her Majesty's Commissioners for the Great Exhibition of 1851 having, conjointly with the Society of Arts, appointed me to commence the formation of a General Collection of the raw Produce and Manufactures of all Countries, as set forth in the Second Report of the Royal Commission, I am now occupied in forming a collection of raw and manufactured ANIMAL PRODUCE of every description; and I am, therefore, desirous of inviting the aid and co-operation of all who are interested in the pursuits of Trade, Commerce, and Manufactures.

The Collection, with the formation of which I am thus charged, will contain samples of the Produce of Great Britain and Ireland, the British Colonies, and also of all Foreign Countries. It will hereafter be arranged and exhibited in the most convenient and instructive manner; and, when complete, will represent the productive resources of each country, accompanied by such statistical and scientific information as may be desirable.

The object of the present circular is to invite Producers, Merchants, Manufacturers, and others, who are disposed to aid, by contributing samples of raw or manufactured animal produce to the Trade Museum, to communicate with me on the subject. . . .

A list of approximately 240 of the articles desired was appended to the letter of which the following are typical: antelope fur; angora goat do.; beaver hats; cow hair; crabs' eyes; gall-stone; horns of all kinds; hoofs of all kinds; peacocks' feathers; penguin skins; portable soup; sea slugs; silk stockings; tartans; teeth; woollen paper, and zebra skins.

Some Activities of Other Societies and Organizations

MEETINGS

WED. 21 APR. Anglo-Israel Association, at the Royal Society of Arts, W.C.2. 6 p.m. General Y. Yadin: *The Dead Sea Biblical Scrolls.*

Petroleum, Institute of, 26 Portland Place, W.1. 6 p.m. C. A. Beard and D. Downs: *Engine Design as Influenced by Fuels and Lubricants.*

THURS. 22 APR. Road Transport Engineers, Institute of, at the Royal Society of Arts, W.C.2. 6.30 p.m. W. T. Skinner: *Some Factors Affecting Fuel Consumption.*

FRI. 23 APR. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. *A Method for the Plotting of Magnetic Fields due to Currents.* (Discussion.)

Navigation, Institute of, at the Royal Geographical Society, S.W.7. 5 p.m. E. W. Barlow and Cmdr. C. E. N. Frankcom: *Surface Currents and their Effects on Navigation.*

MON. 26 APR. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. W. Lawrence: *The Experimental Synthesis of Speech.*

Geographical Society, Royal, S.W.7. 8.15 p.m. G. F. Hudson: *Marco Polo.*

TUES. 27 APR. Anthropological Institute, Royal, at the Royal Society of Arts, W.C.2. 2.30 p.m. Sir Robert Hyde: *The Application of Anthropological Knowledge to our Industrial Society.*

Civil Engineers, Instituton of, Great George Street, S.W.1. 5.30 p.m. W. J. Pugh: *The Geological Survey of Great Britain.*

International Affairs, Royal Institute of, Chatham House, 10 St. James's Square, S.W.1. 1.30 p.m. Louis Kraft: *Africa's Multi-Racial Societies.*

Refrigeration, Institute of, at the Institution of Mechanical Engineers, Storey's Gate, S.W.1. 5.30 p.m. J. F. T. MacLaren: *Valve Behaviour and the Performance of Small Compressors.*

WED. 28 APR. Folk-Lore Society, at University College, Gowe Street, W.C.1. 7.30 p.m. Sir James Scott Watson: *Folklore in Agriculture.*

Meteorological Society, Royal, 49 Cromwell Road, S.W.7. 5 p.m. Dr. O. G. Sutton: *The Development of Meteorology as an Exact Science.*

Victoria & Albert Museum, South Kensington, S.W.7. 6.15 p.m. J. M. Ruiz-Morales: *The Cathedral of Santiago de Compostela, Spain.*

THURS. 29 APR. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. J. A. Ratcliffe: *The Physics of the Ionosphere.*

International Affairs, Royal Institute of, Chatham House, 10 St. James's Square, S.W.1. 8 p.m. Hugh Gaitskell: *The Commonwealth Relations Conference, 1954.*

Wool Education Society, at the Royal Society of Arts, W.C.2. 7 p.m. T. Marchetti: *About Carpet Design.*

OTHER ACTIVITIES

SAT. 24 APR. British Rumanian Friendship Association, at the Royal Hotel, Woburn Place, W.C.1. Exhibition: *Rumanian Folk Art.*

NOW UNTIL 15 MAY. Crafts Centre of Great Britain, 16-17 Hay Hill, W.1. Exhibition: *Furniture with Pottery.*